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PERENNIAL RYE-GRASS STRAIN INVESTIGATION.

SINGLE-PLANT TRIALS AT THE PLANT RESEARCH STATION.

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PERENNIAL rye-grass, like other species of herbage plants, presents marked differences between individual plants within a line. When rye-grass is grown spaced, each individual having sufficient room to carry on its growth unhampered by competition from its neighbours, one finds that the plants vary in growth-form from very lax and spindly to very dense and bushy. The former produce only small amounts of leafage and much stem and stalk, the latter produce more leafy growth and usually give a much higher total yield spread out over a longer grazing-season. Lax spindly plants are usually short-lived, the dense types are more permanent, and therefore more useful for long-term pastures. In the breeding and selection of pasture forms of rye-grass one has therefore to look to the dense leafy growth-forms for our most useful types.

In any scheme of plant-breeding it is necessary to study the behaviour of individual plants which in the aggregate may make up contrasting types or strains. This can only be done by resorting to spaced plant trials. The single-plant study has two main objectives—firstly, as a means for learning the make-up of a line, and, secondly, as a means of culling and selecting to a type that ultimately may be bred up to form an elite strain.

In our trials when dealing with any number of unknown lots the broadcast plot as a pure sowing under a triple system of mowing has come first. Just so soon as differences in behaviour or appearance manifest themselves in the various lots, single plants are lifted at random from all lots that show between themselves the slightest variation. These planted out as spaced plants to allow of full and unrestricted development determine the character of the individuals

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which in the broadcast gave rise to those differences. In elite strain building from the best of the lots studied in such trials the single-plant work, which permits of individual culling, selection, and genetical analysis, must of necessity precede the broadcast trial of an elite strain. The third and final test for any type or strain is in the field, on defined soil-types, under competition with other plants and subject to normal grazing by stock. This three-fold test is regarded as constituting a sound system as a basis for herbage-plant improvement.

In this *Journal* for June last the writers submitted the results of the broadcast trials under the triple system of mowing. The present article deals with the second phase of the trials, and sets out results of preliminary single-plant work in regard to perennial rye-grass.

TECHNIQUE ADOPTED.

The whole of the lines sown out in the broadcast were classified according to type, defined by eye-differences as to colour, form, manner and rapidity of establishment, growth, and other diagnostic features that showed up early in the seedling stages. Fifty-three lines were chosen, including the main and intermediate types, and from these, while the plants were still in the one, two, or three-tiller stage, one hundred single plants were dug up at random, fifty from Series A, and fifty from the duplicate plot of the same line in Series B. Particular care was taken that single plantlets certainly derived from a single seed were used in transplanting. These were planted out as spaced plants in rows 2 ft. apart in the row and 2 ft. between each row. Five rows of twenty single plants per row constituted a plot of each line under test. Between every other plot contiguous to each line for comparative purposes one row of similarly spaced plants was planted of a known type of English indigenous rye-grass. This tested line was supplied by the Welsh Plant Breeding Station at Aberystwyth, and represents a leafy and persistent type from the pastures of Kent, in England.

Using this type as a control had a double advantage in so far as one of the writers has an intimate knowledge of its standards as exhibited under English conditions. It was a known quantity, one might say, while the New Zealand lines were from a type point of view distinctly unknown. This principle we are applying throughout the whole of our trial work at the Plant Research Station, including the testing of lines under the scheme of seed certification now in hand.

This preliminary trial with rye-grass, including the controls, involved the planting of 5,600 plants. This was done during August, 1929, and it early became apparent that very wide differences existed in the individuals between one lot and another, showing clearly that eye-differences in the broadcast were essentially due to differences in the nature of the individuals that made up that line. Further than this, not only do the individuals vary between lot and lot, but marked variation exists among the individuals of any one single lot. In the one lot the type may be *dominantly* true perennial, true Italian, or false perennial, but just as in the broadcast plots a classification into types was possible on eye-appearance alone, so that same classification holds

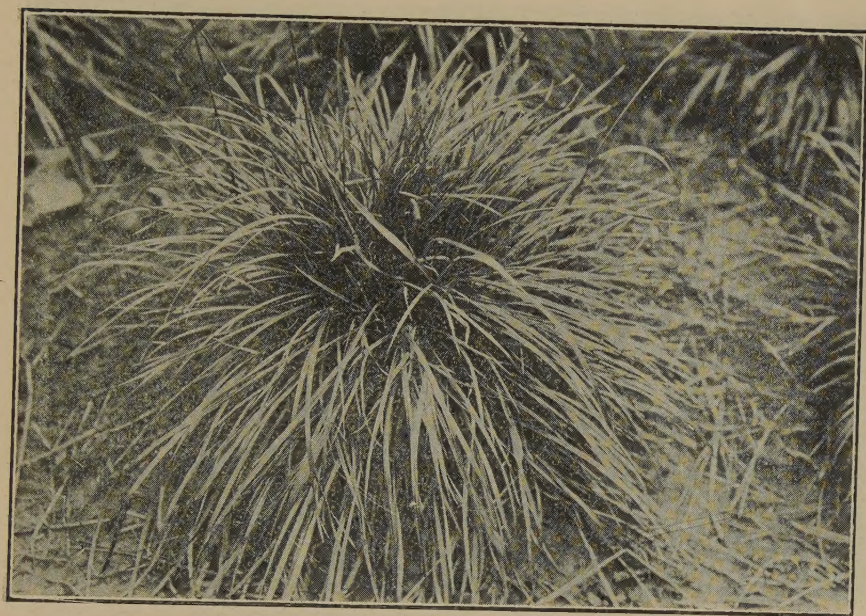


FIG. 1. DENSE LEAFY TYPE OF PLANT.

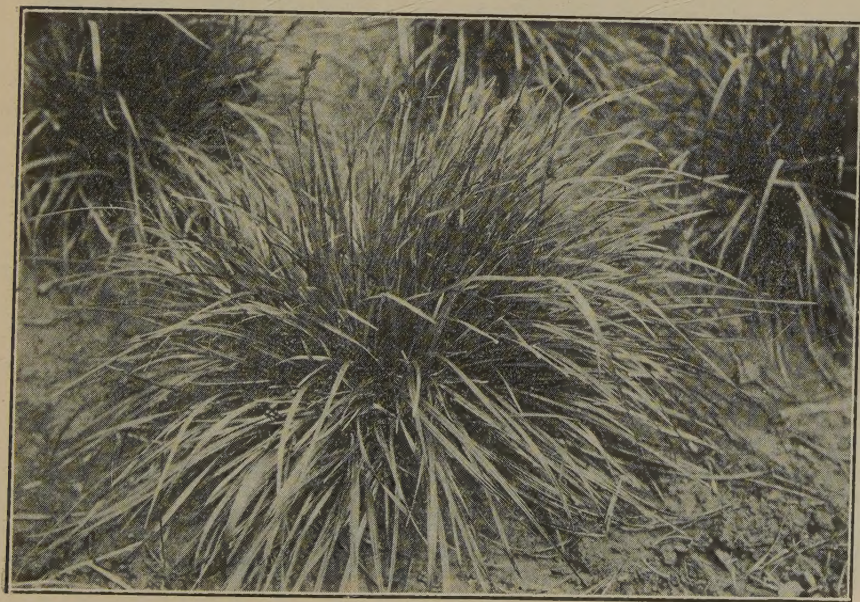


FIG. 2. SEMI-DENSE LEAFY TYPE OF PLANT.

[Photos by E Bruce Levy.]



FIG. 3. SEMI-LAX, EARLY FLOWERING PLANT.

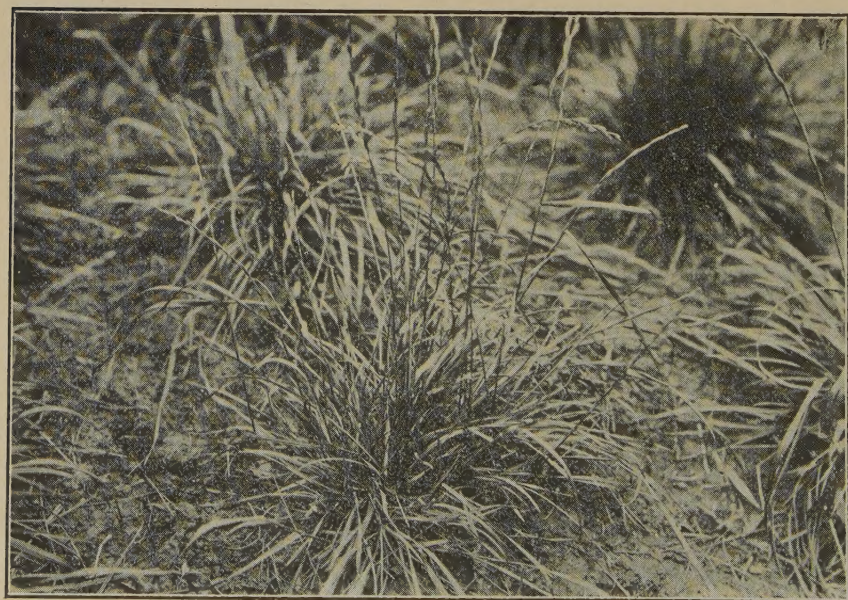


FIG. 4. VERY LAX, EARLY FLOWERING PLANT.

[Photos by E. Bruce Levy.]

in the single-plant study. Jenkin* makes only two groups—"Class A," the perennial end of the series, which would appear to embrace our Types 1, 2, and 3, and "Class B," which would appear to include our average and bad false perennials, Types 4 and 5, and possibly some of our Type 3.

CONSIDERATION OF SINGLE-PLANT ANALYSIS IN RELATION TO TYPES.

TYPE 1: TRUE PERENNIAL RYE-GRASS.

This type is made up of plants dominantly dense-crowned, many-tillered, with stiffly erect leafy shoots, dark green in colour, and contains little or no markedly extraneous types such as definite Italian rye-grass (Type 6) or false perennial of the nature of Types 4 and 5. This is not to say that marked variation does not exist even in the best of the lines coming within this type. Figs. 1 to 4 show four individual plants in a Hawke's Bay line put out as single plants.† Fig. 1 is a fine-leaved, dense-crowned, multi-tillered form essentially of the desired growth-form. Based on our researches we are inclined to the opinion that the ideal type for all-round average conditions in New Zealand will revolve somewhere around this growth-form, and elite strain building is now commencing with plants of this type. Fig. 2 shows a rather coarser type, leafy dense at the crown but hardly as productive as that of Fig. 1. Fig. 3 is a laxer plant, freer-seeding, still fairly dense at the crown, and a good producer. This may represent a definite form of a true perennial, but the general build and behaviour of the plant would suggest a trace of Italian in its make-up. Genetical analysis, however, would be necessary to verify this assumption. With our present knowledge we would eliminate this growth-form in mass selection by culling. Fig. 4 shows a low-producing, free-seeding, open-crowned, few-tillered type; while representing a true perennial rye-grass in the morphological sense it is a type that in all probability would be short-lived.

These four growth-forms, all from one line of Hawke's Bay ryegrasses (Ba 3) show how even a good line may vary within itself, and it is rather interesting to speculate on such a line going into an arable district and being repeatedly sown and harvested year after year for seed-production. It is obvious that of these forms those strains shown in Figs. 3 and 4 are the most ready and most early seed-producers, and when sown and harvested time and time again the line must ultimately run dominantly to these types rather than to the true perennial desirable herbage types of Figs. 1 and 2, which are relatively shy seeders (in the first year at least) and run to leaf rather than to stem.

TYPE 2: TRUE PERENNIAL.

Single plants of Type 2 resemble very closely those of Type 1 in being dominantly of the leafy, dense-crowned, multi-tillered true perennial type, but within this group we place lots that are essentially a wider mixture of types—lots that contain traces of Italian rye-grass (Type 6) and possibly odd plants of Types 3, 4, and 5. This

* T. J. Jenkin, "Perennial Rye-grass at Aberystwyth," *Welsh Journal of Agriculture*, Vol. VI, 1930.

† All photographs in this article were taken on 13th January, 1930, and show aftermath recovery thirty-eight days after cutting.

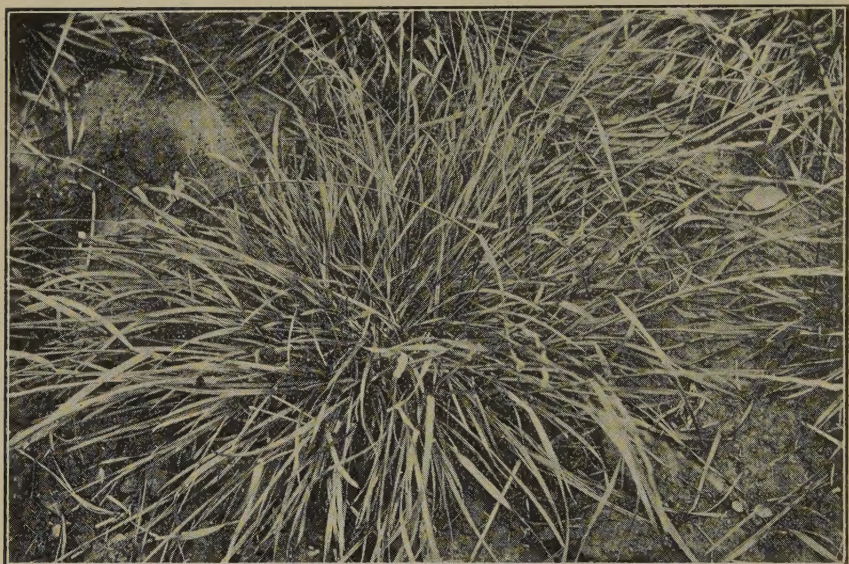


FIG. 5. LAX, PROSTATE, EARLY FLOWERING PLANT.



FIG. 6. ITALIAN RYE-GRASS (LEFT), AND SEMI-LAX PERENNIAL (RIGHT).

[Photos by E. Bruce Levy.]

admixture imparts to the general broadcast plot a somewhat different shade of colour, and for the most part a slightly more rapid establishment from seed.

TYPE 3: GOOD FALSE PERENNIAL.

In the single plant this type varies about a common growth-form such as that depicted in Fig. 5. The crown is more open and the whole flattened and spread out or prostrate. The colour of the leaf is paler than that of the true perennial, and there is a laxness of foliage compared with the more stiffly erect foliage of Types 1 and 2. This slightly paler and duller sheen of Type 3 in the broadcast plot is a distinguishing mark for this type against the true perennials of Types 1 and 2. None the less we must regard this type as being a perennial rye-grass, speaking strictly in the botanical sense. Our experiments go to show that as a type it persists fairly well, but fails to make a sward to approach the true perennial rye-grasses of Types 1 and 2. The best of the South Island rye-grasses is represented in this growth-form and type (Fig. 5).

TYPE 4: AVERAGE FALSE PERENNIAL.

This is undoubtedly the worst of the perennial rye-grasses, and represents probably the ultimate state of deterioration that a perennial rye-grass can reach. The crown is open and few-tillered, stems sparsely foliaged, frequently tinted deeply in red, with definite inclination to spread on the ground. Recovery after the first cut or first grazing is extremely poor, and never at any time, excepting possibly in the first three months after sowing, does this type approach the true perennial in production. In single-plant analysis and as a type it is less uniform than the preceding types, and always contains considerable proportions of hybrid forms that approach in some ways toward the Italian parent. This is demonstrated clearly by Table 1, in which on an average 15 per cent. of the single plants of lines of this type under trial show definite and more or less close affinities with Italian rye-grass, and a further 6 per cent. are intermediates showing closer affinities to perennial rye-grass.

TYPE 5: BAD FALSE PERENNIAL.

Just as Type 4 may be regarded as a degenerate perennial rye-grass at the extreme of the series, so Type 5 may be regarded as a degenerate Italian or admixture of Type 4 crossed with Italian.

Figs. 7 to 9 give a very good idea of one set of individuals of Types 4 and 5, and Figs. 10 to 13 of another set found as regular components of these bad false perennial types. Figs. 7 to 9 show individuals that are apparently throw-backs dominantly to the Italian parent. Fig. 7 is dominant Italian in form and behaviour. The foliage is erect, pale-green in colour, and recovery after first cut, as the photo shows, is quite satisfactory. Compared, however, with true Italian (Fig. 6, plant on left) it is not so tall, nor so leafy in general appearance, and is scarcely awned. Fig. 8 shows less Italian character, growth is much less erect, foliage stiff and coarse, with steely-grey colour rather than the pale yellowish-green of the true Italian. Fair recovery is



FIG. 7.

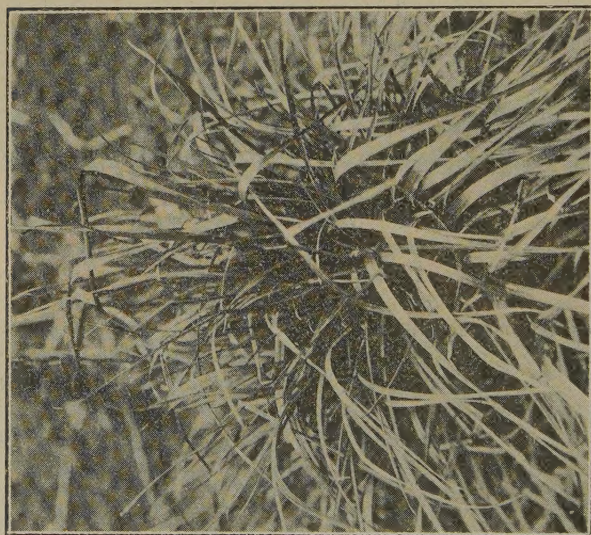


FIG. 8.

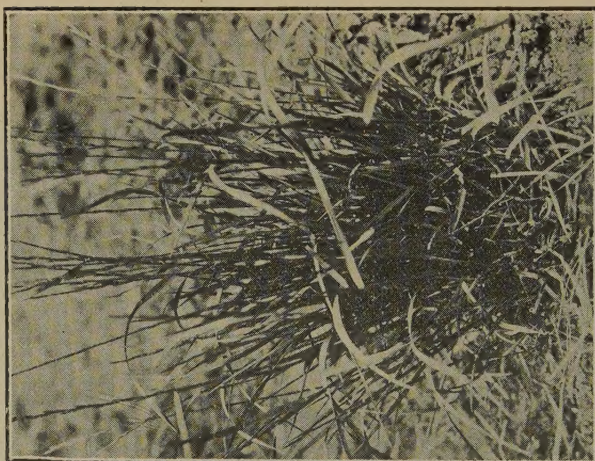


FIG. 9.

INTERMEDIATE TYPES SHOWING ITALIAN RYE-GRASS AFFINITIES.

[Photos by E. Bruce Levy]

shown after the first cut. In Fig. 9 still less Italian tendencies are in evidence, and the degeneration of the type is plainly manifest. The crown is open, with sparse erect tillers with leaves of a decided steely-grey colour, and in this type the stems are often distinctly red in colour. Recovery after cutting is decidedly poor. The steely-grey colour of these false perennials is characteristic, and is discernible right from the seedling stage. It is difficult at this point to say just what is responsible for this colour difference, but the suggestion that it may be due to the excessive production of cuticular wax as has been noted in certain wheats* may have foundation in fact. Whatever it is due to, it is this steely-grey appearance of the leaf-surface, especially pronounced on the under-surface of the leaf, that is largely responsible for the colour differences in broadcast plots, which have been correlated with lack of persistency in the false perennial rye-grass.

Figs. 10 to 13 represent the worst forms isolated and studied within Types 4 and 5. These plants never make much growth, have scarcely any density of crown, are prostrate in form, often purple-red stemmed in the hay stage, and sprawl on the ground. As a group they fail almost entirely to recover after the first cut, and what recovery is made is from stem-tillering rather than from crown-tillering. This characteristic may be seen in Figs. 10, 11, and 12, where the small recovery is made almost entirely by shoots produced at nodes of the old stems. The plant shown in Fig. 13 is quite dead, not having made any recovery after the first cutting-back.

One hundred plants of these false perennials put out as a plot showed up in marked contrast to the true perennial of Type 1. This is clearly indicated in Fig. 14, where on the right is a plot of five rows (100 plants) of a bad false perennial (Type 5 Ba 84) from Southland, and a similar plot of five rows (100 plants), on the left, of Type 1 from Hawke's Bay, the centre row being a control plot of English indigenous perennial the product of Kentish pastures. In the plot on the right of the photo 64 per cent. of the plants failed to recover appreciably after the first cut made at the hay stage, while only 7 per cent. (and these were dominant Italian rather than perennial) showed average recovery after this cut. None recovered as well as the average true perennial types.

Fig. 15, again, shows the marked variation that exists in these false perennial lines. This also is a Southland rye-grass (Ba 86) of Type 5. The line contains some of the worst plants met with in our trials, and also the best plant so far seen in the South Island lots. This good plant is in mid-picture, a dense-crowned, erect, dark-green-coloured plant essentially of the true perennial type. It is the only plant of its type so far met with in South Island lots. The plant in front of this good individual is essentially that degenerate perennial, stalky, red-stemmed form common in Types 4 and 5. On the left mid-distance is a true Italian, and all other plants that show much or some recovery are throwing dominantly to the Italian parent.

From material so mixed as this it would seem a hopeless task to breed up anything that could possibly approach genetical purity, and

* See Biffen and Engledow: "Wheat Breeding Investigations." Cambridge, 1926.



FIG. 10.

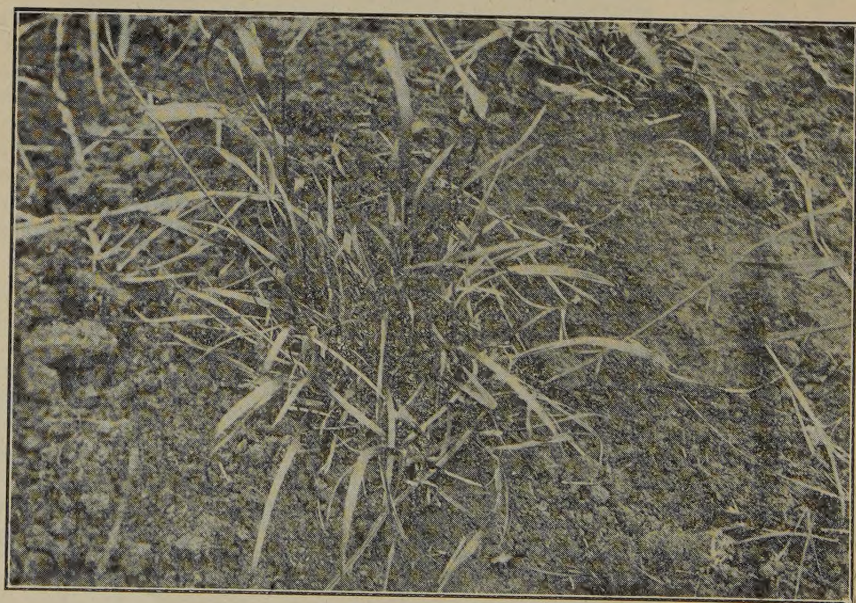


FIG. 11.

INTERMEDIATE TYPES SHOWING SLIGHT RECOVERY AFTER HAY-CUT.

[Photos by E. Bruce Levy.]

readers will realize the wisdom of going straight to the Hawke's Bay product and starting on material that at least has not undergone hybridization and deterioration to anything like the extent of commercial rye-grass from the South.

These photos show in a striking way the marked state of deterioration that New Zealand commercial rye-grass has come to as a result of years of haphazard, unguided seed-production, and one can almost express by means of these pictures the factors that have largely been responsible for this deterioration. If one carries on from the discussion under Type 1, in which is seen the possibility of disappearance of the leafy shy-seeding true perennials and rise to dominance of the stemmy free-seeding types as a result of continuous reaping and sowing, and then imagines a mixture of Italian rye-grass and these free-seeding stemmy perennials sown and harvested together, and that crop again mixed with Italian and sown out, it can readily be perceived, backed by the evidence presented by Jenkin* that Italian and perennial freely cross, and that these hybrids also freely cross and are themselves fertile. It will also be recognized that such a blending of types must ultimately lead to the hopeless state of certain of our New Zealand rye-grasses wherever this annual sowing and reaping and mixing of species and types has been practised.

TYPE 6: TRUE ITALIAN RYE-GRASS.

Many of the lines offered for sale as perennial rye-grass or simply as rye-grass proved to be straight-out Italian. This type is of a pale-green colour, very rapid in establishment, erect in growth, comparatively few-tillered, but producing leaf well up the stems and recovering well after first and second cutting (Fig. 6 plant on left). Recovery of Italian and a true perennial (plant on right) after first cutting may be compared in this photo.

ENGLISH INDIGENOUS TYPE USED AS CONTROL.

The Aberystwyth line used for control plots in this experiment gave rise to very dense plants, and these are considerably finer in the leaf than the dense plants of Hawke's Bay (Type 1). As in the New Zealand Type 1, the tillers were closely packed at the crown and tended to the erect rather than prostrate (compare Figs. 16 and 1). This line has proved to be very persistent in broadcast plots under weekly mowing, but under New Zealand conditions has failed to stand up to normal sward competition, and did not make as much growth during the first two years as the best Hawke's Bay types. This latter evidence is confirmed by the single-plant studies and also by the Aberystwyth trials†. It flowered fourteen to twenty days later than the average dense plants of the best New Zealand rye-grass, but there was considerable variation within the line both in regard to growth-form and date of flowering. Figs. 16, 17, and 18 show some degree of this variation as to type, and clearly indicate that perennial rye-grass even from exceedingly old-established swards may contain many undesirable types that call for elimination in any modern scheme the aim of which is elite-strain breeding.

* T. J. Jenkin: "Artificial Hybridization of Grasses." Welsh Plant Breeding Station, Aberystwyth. Bul. Ser. H., No. 2 (1924). See also Jenkin, loc. cit.

† See Jenkin, loc. cit.



FIG. 12.

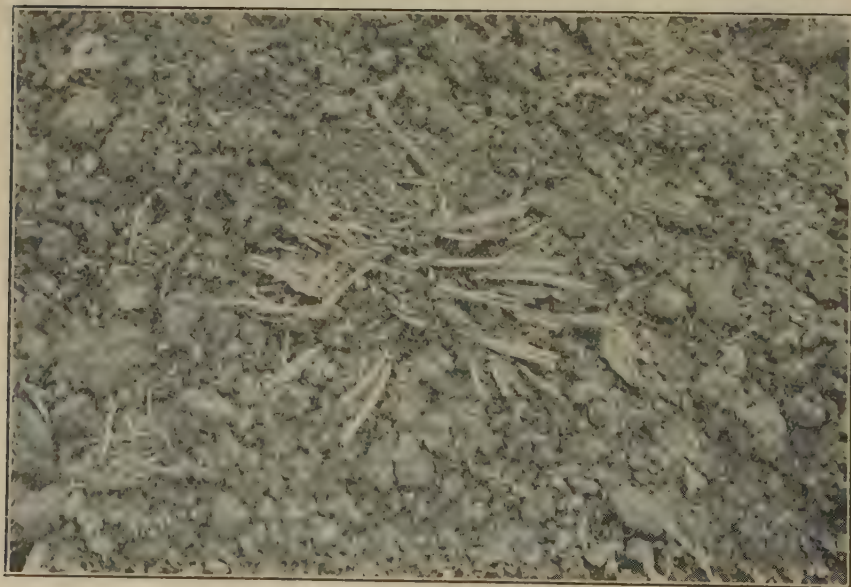


FIG. 13.

INTERMEDIATE TYPES SHOWING LITTLE AND NO RECOVERY AFTER HAY-CUT.

[Photos by E. Bruce Levy.]

DATA IN RELATION TO RYE-GRASS TYPES WITHIN GROUPS 1 TO 6.

Table 1 gives an analysis of 5,200 single plants based on examination of each plant from the botanical characteristics viewpoint. It emphasizes the mixed nature of the ordinary New Zealand commercial types that exist to-day, and clearly sets out the affinities towards the true perennials of Types 1 to 3, with increasing Italian affinities in Types 4, 5, and 6. The point we wish to stress is that the hybrid with perennial affinities is not so good as the true perennial, nor is the hybrid with Italian affinities as good as the true Italian. Looked at from every angle, it seems that Types 4 and 5 and ultimately Type 3 must be eliminated from the seed-trade of New Zealand, and under no consideration should importations of this type of seed be made. We must in future aim at the pedigree true-bred perennial, on the one hand, and the pedigree true-bred Italian on the other.

Table 1.—Showing Affinities of the respective Rye-grasses in Types 1 to 6.

Type No.	Number of Lines under Trial (Single Plants).	Perennial.	Intermediates approaching Perennial.	Intermediates approaching Italian.	Italian.
1	24	95*	2	2	1
2	1	94*	1	5	..
3	13	92†	5	2	1
4	7	79†	6	11	4
5	6	25†	19	44	12
6	1	..	..	..	100

* Dominantly dense and semi-dense plants of types shown in Figs. 1 to 3. † Dominantly grey, prostrate, or lax plants of types shown in Fig. 5. ‡ Dominantly lax, sparse-tillered plants as in Fig. 4.

RECOVERY AFTER CUTTING.

The single plants were cut back on the 6th December, 1929, when they were all in full flower, with the exception of the line from Aberystwyth, which had not at this date attained maximum flowering. The experiment had unfortunately to be abandoned in February, 1930, consequent upon a lack of tenure of the experimental ground. The hay cut in December was therefore the only crop taken in this trial. All the photos were taken on 13th January to show recovery (thirty-eight days) after the first and only cutting.

* When dealing with our broadcast trials in the previous report it was shown that in the aggregate Types 3, 4, and 5 do not recover, nor show vigour after repeated cutting, and that Italian rye-grass (Type 6), while recovering well at first, failed to persist after mid-season. The true perennials of Type 1, however, have in all cases recovered excellently from cutting, and in the majority of cases have made adequate recovery, and have persisted very well under a system of weekly mowing. The single-plant studies have very definitely shown that there is a direct relation between the density of the plant and its ability to withstand repeated defoliation, thus confirming the work of Stapledon at Aberystwyth.

Table 2 shows the relative recovery of Types 1 to 6 at two recording dates subsequent to the hay cut in the spaced plant trial. Growth



FIG. 14. ON LEFT, NEW ZEALAND TRUE PERENNIAL ; IN CENTRE (ONE ROW), ENGLISH INDIGENOUS ; ON RIGHT, NEW ZEALAND FALSE PERENNIAL.



FIG. 15. CLOSE-UP VIEW OF PLOT OF FALSE PERENNIAL.

[Photos by E. Bruce Levy.]

Table 2.—Average relative Recovery after Cutting (Type 1=100 at each Date).

(The only cut was made on 6/12/29.)

—	Types 1 and 2.	Type 3.	Type 4.	Type 5.	Type 6.
Relative recovery at 16/12/29 ..	100	96	90	65	III
Relative recovery at 4/1/30 ..	100	85	63	33	*

* No data.

marks on a scale 0-10 were given each plant at the two dates, and Type 1 has in each case been placed at 100, the other data being adjusted accordingly. Types 3 and 4 in the aggregate did not recover as well as Type 1 even under this very lenient treatment, where competition was nil and after only one hay-cut. Not only did the true perennials recover more quickly, but they maintained a more rapid rate of growth, outyielding Types 3, 4, and 5 by a wider margin at the end of a month than after the first week subsequent to cutting. These data are extremely significant when it is realized that all the plants were under more or less ideal conditions of soil, fertility, and spacing. Competition for light or nutrients must have been all but negligible under the conditions set up in the trial, and yet after one cut, made when the plants were only about nine months old, the false perennials failed to make adequate recovery. Type 5, on the average of 600 spaced plants, made only 33 per cent. as much growth in the month as the average for Types 1 and 2. Italian rye-grass (Type 6) behaved normally and recovered rather more rapidly than the true perennials, and this really goes to emphasize the relative poorness of the false perennial types and especially of the intermediate forms so conspicuously dominant in Type 5. The photographs will serve to emphasize this point.

RUST-RESISTANCE.

Leaf-rust (*Puccinia coronata*) was severe in the rye-grass trials as a whole during the early summer of 1930. There was also a slight attack of stalk-rust (*P. graminis*), but this did far less damage than the former. The relative degree of resistance to rust attack was quite a feature of the plots. In the broadcast trials spring-sown lots of Hawke's Bay rye-grass (Type 1) were particularly marked by their relative resistance to leaf-rust in comparison with Southern (together with imported) seed conforming to Types 3, 4, and 5. The single-plant work demonstrated, furthermore, that the dense leafy types are much more resistant to disease than are the stalky open-crowned forms. Italian rye-grass proper appears to be fairly resistant to leaf-rust, but the less vigorous intermediate forms are definitely susceptible to attack. It is, however, difficult to give reliable figures bearing on this point, since in our spaced-plant trials so large a proportion of deaths and non-recovery occurred among the intermediates following the hay-cut. Rust attack was hardly noticed prior to cutting the hay, and attained its greatest relative severity in early February (1930).

To the plant-breeder the practical outcome of the rust study has been to show that there exist forms of perennial rye-grass which appear to be highly resistant or may be completely immune to leaf-rust, and



FIG. 16.

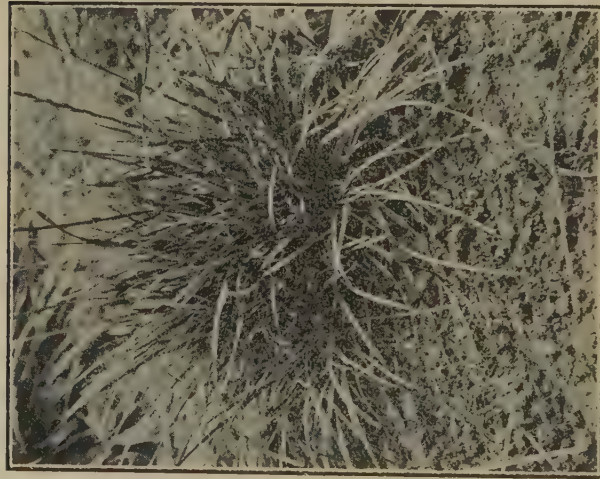


FIG. 17.



FIG. 18.

SHOWING RANGE OF VARIATION IN ENGLISH OLD PASTURE RYE-GRASS.

[Photos by E. Bruce Levy.

it is wholly encouraging to find that the most dense growth-forms are those most resistant to disease. This means that in the breeding of pasture-plants one may be able to employ quite simple diagnostic characters in the selection of types and the determination of growth-forms likely to be of greater economic value as parent material in the production of improved and elite strains. It also emphasizes that disease-control in rye-grass is a problem for the plant-breeder as well as for the mycologist—the breeding of immune strains of pasture-plants may well vie in importance with similar work that has made considerable advances in regard to the cereals.

The single-plant trials have been decidedly encouraging, and it is now possible to start more intensive studies on the best of our single plants with the hope that these may be used as parent material in connection with economic plant-breeding in general and relative to genetical studies in particular—projects fraught with immense possibilities for the increase and for the betterment of grassland-production in pastoral New Zealand.

CONCLUSION.

In the past in New Zealand emphasis has been laid upon the importance of the species' make-up of a sward, the proper manuring of that sward so as to encourage good grasses and clovers to grow, and the efficient management of the pasture in conformity with the ecological requirements of our major grassland species. Now comes a fourth essential factor—that of strain within the species. One may now regard (1) species, (2) strain, (3) adequate fertility, and (4) good management as the four fundamental principles upon which to work to build up our pastures to the very best possible in economic grassland-production.

Our thanks are due to Messrs. S. H. Saxby and L. Gorman, of the Plant Research Station staff, for assistance in connection with the trials under review. Also we are indebted to Mr. J. W. Todd for superintending field-work on the plots.

Effect of Sprayed Chlorates on Pasture.—A correspondent asks, "What is the effect on pasture after spraying ragwort with sodium or calcium chlorate?" The experience of the Fields Division is that when the material is used at strengths of not more than 5 per cent. there is only slight burning, and the pastures rapidly recover, although the ragwort is effectively destroyed. Stronger solutions (10 to 20 per cent.) cause more burning, and pasture takes a considerable time to recover. Heavy dressings (1 cwt. to 2 cwt. of the crystals per acre) destroy most of the pasture, but reseedling takes place in a few months. Apparently any bad effects from the chlorates disappear in from four to six months. This is also the experience in other countries.

Bees and Orchard-spraying.—In his book, "Profitable Honey Plants of Australasia," Mr. Tarlton Rayment remarks: "Bee-farmers adjacent to orchards often lose heavily because of ignorant growers who persist in spraying—with poisonous compounds—trees in full bloom. Though it is very necessary to spray for the purpose of keeping fruit pests in check, scientists have demonstrated the danger of damaging the pollen at certain stages. A decreased percentage of pollinization (consequently less fruit set) frequently results from the ill-directed use of poisons. Fortunately, all progressive orchardists are well aware that the proper time to spray is just before the blossoms open and again as the petals fall."

POTATO-MANURING IN THE SOUTH ISLAND.

RECOMMENDATIONS TO GROWERS FROM EXPERIMENTS OF SEASONS 1924-25 TO 1929-30.

Fields Division, Department of Agriculture.

DURING the past six seasons over sixty experiments have been conducted by the Fields Division on the manuring of potatoes. A report dealing more fully with these trials will be published in a subsequent issue of the *Journal*. It is considered desirable, however, to present the salient features of these trials and the recommendations arising from the results for the guidance of farmers prior to the planting season of 1930-31.

Up to and including 1927-28 the work was confined to Canterbury, but in 1928-29 it was extended to Otago and Southland, and in 1929-30 to Marlborough. Two experiments were conducted in 1924-25, and over twenty in 1929-30.

Only those experiments which have formed the major part of the work are considered here. Two principal types of experiments will be dealt with—namely:—

- A. Those in which different quantities of superphosphate were compared with one another and with no manure.
- B. Those in which the effect of adding potash and nitrogen to superphosphate was investigated.

Type A Experiments.

The treatments were: (1) No manure; (2) super at 3 cwt. per acre; (3) super at 5 cwt. per acre; (4) super at 7 cwt. per acre.

SUPER 3 CWT. PER ACRE VERSUS NO MANURE.

It has been possible to compare the effect of using 3 cwt. of super per acre against no manure in thirty-six trials. In thirty-one of these super gave significant increases in yield of table potatoes ranging from 4 cwt. to $2\frac{1}{2}$ tons per acre. A summary of the approximate average increases per acre of the table and seed potatoes, calculated on thirty-six experiments, is as follows: Table, 20 cwt.; seed, $6\frac{1}{2}$ cwt.; total, $26\frac{1}{2}$ cwt.

NOTE.—In all trials the yields of small potatoes, which are usually left on the ground or fed to pigs, were also measured, but are not included here.

SUPER 5 CWT. VERSUS SUPER 3 CWT. PER ACRE.

These treatments have been compared in nineteen experiments. In seven trials super 5 cwt. caused significant increases over super 3 cwt. Most of the increases occurred on land of natural high fertility and good water-retaining capacity, such as the Kaiapoi potato soils in Canterbury. The average increase per acre of super 5 cwt. over super 3 cwt. for nineteen experiments is as follows: Table potatoes, $4\frac{1}{2}$ cwt.; seed, 2 cwt.; total, $6\frac{1}{2}$ cwt.

SUPER 7 CWT. VERSUS SUPER 5 CWT.

Only three out of nineteen experiments revealed a significant superiority of super 7 cwt. over super 5 cwt. in yield of table potatoes. The average over the nineteen trials shows a superiority of super 7 cwt. over super 5 cwt. to the extent of 4 cwt. of table potatoes and 1 cwt. of seed per acre.

Type B Experiments.

The treatments were: (1) Super 3 cwt.; (2) super 3 cwt., plus sulphate of ammonia 1 cwt.; (3) super 3 cwt., plus sulphate of potash 1 cwt.; (4) super 3 cwt., plus sulphate of ammonia 1 cwt., plus sulphate of potash 1 cwt.

EFFECT OF ADDING NITROGEN IN THE FORM OF 1 CWT. OF SULPHATE OF AMMONIA TO SUPER.

Comparisons between super plus sulphate of ammonia and super have been made in thirty-three experiments. In eighteen of these significant increases in the yield of table potatoes due to sulphate of ammonia have ranged from 6 cwt. to 24 cwt. per acre. The average increases per acre in table and seed potatoes for the thirty-three experiments are as follows: Table, $9\frac{1}{2}$ cwt.; seed, 5 cwt.; total, $14\frac{1}{2}$ cwt.

Climatic conditions rather than soil-fertility appear to effect the response to nitrogen. Dry conditions, especially after December, seem to inhibit the beneficial action of nitrogen.

EFFECT OF ADDING SULPHATE OF POTASH TO SUPER.

Out of thirty experiments potash has increased the yield of table potatoes significantly in nine cases. The increases have ranged from 6 cwt. to 36 cwt. The average increases per acre in table and seed potatoes for the thirty experiments are: Table, $5\frac{1}{2}$ cwt.; seed, $1\frac{1}{2}$ cwt.; total, 7 cwt.

Soil rather than climatic conditions appear to effect the response to potash. Potash responses have been most marked in Southland at Gore and McNab, but have occurred in Canterbury at Temuka, Willowbridge, Mitcham, Kirwee, and Leeston.

EFFECT OF USING A COMPLETE MIXTURE OF SUPER, PLUS SULPHATE OF POTASH, PLUS SULPHATE OF AMMONIA.

In general, sulphate of ammonia has given results when added to super plus potash similar to those resulting from its addition to super alone. Results from potash added to super plus sulphate of ammonia have been somewhat similar to those resulting from the use of potash with super alone. The scope of this article does not allow full discussion of a few anomalous results which have occurred.

Recommendations to Farmers.

(1) The use of super at 3 cwt. per acre is strongly recommended. On the better-class potato soils heavier quantities are worth trying, but on the lighter soils, less retentive of moisture, there is no justification for using more than 3 cwt.

(2) The indications are that, if used consistently, sulphate of ammonia at 1 cwt. per acre *as an addition to super* will pay. Since response to nitrogen appears to be governed by the season's weather conditions, and since it is not possible to forecast these conditions, it seems likely that only the consistent use of sulphate of ammonia can hope to recover in the good "nitrogen seasons" what little it may lose in the unfavourable ones.

(3) In parts of Southland potash appears to be the most important limiting manurial factor in potato-growing, and its use, especially in conjunction with superphosphate, should not be neglected. Sulphate of potash should be used. In Canterbury the trial of potash would appear to be justified in the districts indicated. The results indicate that potash is not such an important factor in Canterbury as in England and Europe, where it is used almost universally for potatoes.

(4) A limited amount of experimental evidence indicates that application of manures in the row is better than broadcasting before sowing. Where suitable machinery is not available, hand application in the row should be practised.

—A. W. Hudson, *Crop Experimentalist, Plant Research Station, Palmerston North.*

WINTERING OF STORE PIGS.

THE VALUE OF MEAT-MEAL.

K. W. GORRINGE, Instructor in Swine Husbandry, Live-stock Division.

THE satisfactory feeding of growing pigs in this country during the winter, when skim-milk or whey is not available, has up to the present been very difficult—so much so, indeed, that many farmers avoid autumn farrowing or make no effort to carry store pigs through the winter. The unsatisfactory position of the autumn litter in New Zealand is well shown by the average number of pigs marketed per sow. There are in the Dominion about 70,000 breeding-sows, and the total number of pigs killed per year approximates 500,000, or seven pigs per sow. Of this number less than 100,000 represent pigs that are brought through the winter, the remainder being derived from spring litters.

In order to put pig-rearing on a satisfactory basis it is essential that the number of pigs marketed per sow should be increased to at least twelve, by making the production from late summer and autumn farrowing as efficient as is spring farrowing. The only way that this can be done is to carry through the winter all autumn litters in a healthy and thriving condition, so that when dairy by-products become available they can be rapidly and profitably converted into pork or bacon.

Dairy-farmers can provide at a cheap rate an abundance of roots—particularly mangels—for the feeding of store pigs. Mangels, by themselves, can be viewed as practically useless for the wintering of young pigs, but when supplemented with a flesh-forming food they are quite satisfactory for efficient use from the weaner stage onwards. Up till quite recently an efficient and reasonably priced flesh-forming

food for winter feeding was not available to the pig-raiser, and this was the prime reason why the unsatisfactory position of the wintering of store pigs arose. Fortunately the pig-farmer has now at his command an excellent food in the shape of meat-meal, which at the price being charged—about £11 to £12 per ton—may be regarded in combination with roots such as mangels as sufficiently cheap to make the wintering of young pigs effective and profitable.

A recent experiment at Canterbury Agricultural College, conducted by Mr. M. J. Scott, demonstrated that with meat-meal fed at the rate of $\frac{1}{2}$ lb. per day in conjunction with mangels young pigs made satisfactory and profitable winter gains. The result of this experiment was viewed by the Department of Agriculture as so important that the Department decided to carry out a series of trials in co-operation with farmers, in order to find out exactly what live-weight increases took place when young pigs were fed through the winter simply with farm-grown roots supplemented with $\frac{1}{2}$ lb. of meat-meal per pig per day, and under ordinary farm conditions.

Trials with mangels and meat-meal have been carried out on eleven farms, nearly two hundred pigs being placed under test. In these trials it has been shown that pigs from the weaner stage onwards, winter-fed with mangels supplemented with $\frac{1}{2}$ lb. of meat-meal per day, put on just over $\frac{1}{2}$ lb. of live-weight increase per day. In other words, 1 lb. of meat-meal produced 1 lb. live-weight increase. As meat-meal costs a little over 1d. per pound, and 1 lb. of live-weight increase can be put down as worth not less than 4d., feeding with mangels and meat-meal can be viewed as highly satisfactory, and provides an efficient method whereby profitable wintering of store pigs can be undertaken.

The general adoption of wintering store pigs on meat-meal and roots (particularly mangels, as they can be produced on small farms cheaper than any other root crop) is likely to revolutionize pig-raising in this country by enabling autumn litters to be as profitable if not more so than those spring farrowed. Every £1 spent on meat-meal for the wintering of pigs would appear to be capable of returning £4, provided adequate quantities of farm-grown roots are available and management conditions are reasonably good.

A report giving particulars of the Department's co-operative trials will be published shortly in the *Journal*.

Late Infestation of Codlin-moth.—Mr. G. H. McIndoe, Orchard Instructor, reporting on this subject, states: "The possibility of late moth infection was exemplified at Gisborne last season. Up to the latter part of February the weather was cold and wet, with every indication of an early autumn. It was reasonably expected that the February spray would give all the protection desired. In the first week of March the weather became hot and dry, and towards the middle of March newly hatched grubs were very plentiful. It would appear that either the flight of the earlier broods was delayed by the cold weather, or that higher temperatures promoted a flight which normally should not have occurred until the spring. Up to the end of March, which was the driest for over fifty years, fresh hatchings were still noticeable."

THE BLUEBERRY.

ITS DEVELOPMENT IN NORTH AMERICA AND THE NEW ZEALAND INTRODUCTIONS.

W. K. DALLAS, Plant Research Station, Palmerston North (late Orchard Instructor, Dunedin).

THE blueberry belongs to the genus *Vaccinium*. It is allied to the bilberry, huckleberry, and mountain cranberry. The high-bush blueberry of the eastern United States of America is *Vaccinium corymbosum*, while the low-bush species is *Vaccinium angustifolium*. The bilberry, sometimes called whortleberry, is *Vaccinium myrtillus*; it is a native of Britain and Northern Europe, where it grows on the high moorlands and peaty bogs; its fruits are gathered and are used for making jellies and tarts. The huckleberry, which is a native of North Carolina, is *Vaccinium hirsutum*. The mountain cranberry is *Vaccinium erythrocarpum*, and grows wild in the south-eastern United States. Berries which grow in Alaska, Washington, and Oregon have been identified as being *Vaccinium ovalifolium*, a tall species, bearing blue fruits; *Vaccinium parvifolium*, bearing bright-red berries; and *Vaccinium membranaceum*, which bears dark-purple berries. These berries are said to be neither true blueberries nor huckleberries, but related to the whortleberry.

In Canada the wild-blueberry crop is one of the most profitable of the berry crops grown in that country, and it has a commercial value equal to if not greater than that of the strawberry. In 1926 the blueberry crop, in addition to furnishing the needs of the people of Canada, had a surplus available for export amounting to 3,644,551 lb., worth approximately £66,600. This value was said to be about five times greater than the strawberry crop exported that season. The only labour required for profiting from the wild blueberries is that of picking, for there is no expense in planting and cultivating the crop.

During the past seventy years much investigational and hybridizing work has been done in connection with the blueberry. Eleven new commercial varieties of improved blueberries have been developed through selection and breeding. The new varieties have been evolved from the high-bush blueberry, *Vaccinium corymbosum*.

The blueberry grows wild in many parts of the United States. The hardy low-bush species flourishes in and about bogs and swamps in the States of Maine, Minnesota, New York, and Wisconsin. The plants are generally small in stature, with slender stems and fine roots. These plants increase naturally by means of underground stems or rhizomes, which push out from the more vigorous plants to a distance of from 2 ft. to 3 ft. The tips of the stems then turn upwards and grow out of the soil and develop leaves. The young plants continue to grow and develop branches and roots, and become self-supporting. Each parent plant sends out from three to four rhizomes each year. The low-bush plants in their wild state produce clusters of berries which vary in number per cluster up to fifteen, while under cultivation an average of thirty to forty berries to the cluster is usual.

The high-bush blueberry of the eastern United States in its native habitat grows to a height of from 4 ft. to 15 ft. The fruit is black in colour and of the size of a black currant. Selection and hybridization has increased the size of these fruits up to $\frac{5}{8}$ in. in diameter.

There was a time when little attention was paid to the commercial culture of the blueberry. People in the vicinity of the wild blueberry areas gathered the fruits and marketed them. As the fruit became better known and appreciated the demand for the berries increased. Prices were sufficiently encouraging as to induce a number of people to cultivate the bushes. One enterprising settler in Florida made a collection of the best wild forms growing in his district, sufficient to plant $2\frac{1}{2}$ acres of drained swamp land. The plants grew much better and produced a greater quantity of berries under cultivation than they did in the wild state. The venture was quite successful, and it was the means of attracting others to cultivate the blueberry for commercial purposes.

Dr. F. V. Colville, botanist to the United States Government, became interested, as also did the nursery firm of Joseph J. White, Inc., of Whitesbog, New Jersey, in the improvement of the blueberry. Dr. Colville devoted a great deal of time and energy to blueberry-breeding experiments at Washington. As an instance of the labour involved in introducing new hybrids it may be stated that out of more than 27,000 plants set out in the trial grounds and tested only three were considered worthy of being named and of being placed on the market. By 1928 Dr. Colville had raised eleven hybrid plants which he considered of sufficient merit for propagation for commercial purposes. Mr. White has propagated and was recently growing in his nursery at Whitesbog 25 acres of selected and tested plants.

Trials which have been made with the hybrid blueberries indicate that Carbot is the best early variety, that Pioneer is the most desirable mid-season variety, and that Rubel the finest late blueberry. A second choice of varieties may be made from the following: Early season—Adams; mid-season—Sam, Rancocas, and Katherine; late season—Grover, Harding, and Dunfee.

The Pioneer variety is described as follows: "Pioneer (Colville hybrid 620A) was the first seedling from the Government trial grounds to be selected for further propagation. It grows with wiry branches to a height of 6 ft., forming a neat bush 4 ft. in diameter. The leaves are from 1 in. to 2 in. long and $\frac{3}{4}$ in. across. The flowers are of a waxy greeny-white colour, with sometimes a tinge of pink, and are produced in clusters. Each berry is light blue in colour and measures $\frac{1}{2}$ in. in diameter. When fully ripe the berries are very sweet. The seeds are so small that they are hardly noticed when the fruit is being eaten."

Blueberry plants begin to bear when three years old, but as a rule they do not produce full crops until they are from five to ten years of age. Hybrid blueberries planted out at a distance of 3 ft. by 5 ft. apart yielded at the following rate: First year after planting, nil; second year, no commercial crop; third year, 30 bushels per acre; seventh year, 96 bushels per acre; eighth year, 117 bushels per acre.

The berries range in size from the size of a black currant up to $\frac{5}{8}$ in. in diameter. The bushes producing the larger berries have been specially

developed through hybridization. To ensure a satisfactory crop it is advisable to plant together two or more varieties which flower at the same time, for cross-pollination purposes.

There is nothing unusual about the harvesting of the blueberry crop. The berries require to be handled as carefully as the fruit of other berry-plants. The fruit is picked as soon as it is fully ripe, as is indicated by the colour at the stem end of the fruit. The berries do not drop readily, and hang well on the bushes. They also keep and carry well.

Speaking of propagation of the blueberry Stanley Johnston, of the South Haven Experiment Station, Michigan, says,—

The difficulty of propagating the blueberry has been the chief obstacle in the way of rapidly developing the cultivated-blueberry industry. Budding and grafting are out of the question, except for experimental purposes, for the reason that new shoots are continually being sent up from the crown of the plant below the graft union. If plants are already established, mound layering is the easiest method of propagation. However, only a small number of rooted shoots are obtained from each plant by this method, and it is necessary to sacrifice the crop of the parent plant. The rooting of cuttings is a slow, difficult task; in fact, it is a task for an experienced propagator. Even then the percentage of rooted cuttings is low, averaging about 25 per cent. No doubt the scarcity of propagating wood of the improved varieties, together with the difficulty of propagation, accounts for the present high prices of the plants. Various experiment stations are working on the problem, and undoubtedly considerable valuable information will soon be available.

The soil requirements are stated briefly by L. M. Ware, of the Alabama Board of Horticulture, as under:—

It is established, practically beyond question, that the blueberry can be raised on varying types of soil with little cultivation, little fertilization, no spraying, no pruning, and with little care. Plantings were examined on deep sandy soil with practically no clay subsoil, both in well-drained upland and more retentive soil of lowlands, and in all cases the berries seemed to be producing abundantly. Plantings were also examined under different conditions of cultivation and fertilization. On uncultivated, unfertilized plantings the berries seemed to be producing abundantly, but where cultivated and fertilized had responded well to the additional care. An ideal type of soil is a sour, sandy soil with a fair amount of peat or humus, and with a permanent supply of soil-moisture, but still well drained.

Summarizing Dr. Colville's advice, success in blueberry-culture rests particularly on—

(1) An acid soil—especially one composed of peat and sand; the possession by the roots of a fungus that appears to have a beneficial function in supplying them with nitrogen.

(2) Good drainage and good soil-aeration. Although high-bush or swamp blueberry occurs frequently in swamps or other wet places, the plants occupy situations which are exposed to the air during the root-forming period of summer and autumn.

(3) Permanent but moderate soil-moisture.

Growers may here be warned not to apply lime to the soil, because it affects the plants like poison. The blueberry plantation should receive the same good attention as is given to other berry fruits in cultivation. Blueberries respond to clean cultivation and a system of green cropping. On account of the shallow rooting of the plants the cultivation must not be deep, otherwise much serious damage will be done to the roots of the plants. In hot summers the plants should be mulched with peat, lawn trimmings, or any suitable garden refuse. Stable manure is injurious to the bushes, and should not be used.

Beneficial results have been obtained by the use of the following fertilizers in early spring: nitrate of soda, 100 lb.; rock phosphate, 260 lb.; sulphate of potash, 40 lb. per acre. This is followed by a second application of nitrate of soda at the rate of 100 lb. per acre at blossoming-time.

The low-bush varieties may be planted at a distance of 3 ft. by 6 ft. This will provide the plants with plenty of room for many years, and provide adequate room for cultivation. The high-bush blueberries require to be planted up to 20 ft. apart, according to the dimensions to which the mature bush develops.

The blueberry appears to be particularly free of disease, and, as far as can be learned, requires no spraying. In Maine the blueberry maggot has been recorded as attacking the berries and causing loss. Birds are fond of the berries, and will devour them as they ripen unless steps are taken to protect the fruit. In parts where there are rabbits the bushes should be protected, as the rabbit appears to be fond of the shoots.

The blueberry as a garden plant is a welcome addition to the shrubbery, and, like most *Vacciniums*, its crimson leaves in the autumn add to the splendour of the garden. Its autumn effect in the garden was known long before any value was placed on the berries.

The New Zealand Introductions.

Whether or not blueberries will become a commercial success in New Zealand still remains to be proved. The majority of the plants which have been introduced through one reason and another have not flourished as was expected when they were planted. Unsuitable soil conditions have been principally responsible for so many of the plants doing poorly in the past. During the past year, however, a number of the plants have been transplanted to more congenial conditions, and already they have made new healthy growth.

The varieties which have been introduced into Otago and Southland during the past seven years are tabulated below.

Variety.	Number of Plants introduced.		Total Plants.
	Invercargill.	Dunedin.	
Rubel	2	1	3
Sam	5	1	6
Harding	3	1	4
Adam	1	..	1
Grover	..	1	1
Pioneer	..	1	1
Dunfee!	1	..	1
Names not known	5	..	5
Total	17	5	22

NOTE.—Two plants—one Dunfee and one Sam—have died.

Following are a few notes regarding the plants which have succeeded best so far (June, 1930):—

A bush of Rubel growing at Otatara, near Invercargill, is now 3 ft. 6 in. high and fruiting regularly. Sufficient fruit was obtained in

the past season to make some jam, which in colour and flavour was somewhat similar to that of Cape gooseberry. When fully ripe the fruit was of the size and had the mild flavour of the Black Champion currant. The plant blossomed at the end of October, the flowers being of similar size and shape to those of heath-bells. When the flowers opened the colour was pale pink, but later it changed to an ivory white. The fruit is ripe at the end of January or beginning of February.



RUBEL BLUEBERRY BUSH GROWN BY MRS. T. J. PALMER, OTATARA.

On right, some of the fruit.

The bush of Sam growing at Maori Hill, Dunedin, is 3 ft. 6 in. high. In the past season it carried eight sprays of fruit, with from six to twenty fruits per spray.

The Grover is 3 ft. high, and bore thirty-eight sprays of fruit in the past season, with up to ten fruits per spray. Several pies were made with the berries, which were declared to be delicious. Blueberries and cream were also tried and were much appreciated. The slight acidity, together with the flavour of the berries, made a delightful dish.

Apart from the fact that blueberries provide a very nice dessert fruit, an important point which recommends them for further testing is that they may be the means of bringing into production some of our lands which are at present of little value for anything else. Blueberries would probably grow well on the sandy-peat soils in various parts of New Zealand when the land was drained, and might be the means of additional income being derived from such areas.

STRATFORD DEMONSTRATION FARM.

NOTES ON OPERATIONS, SEASON 1929-30.

J. M. SMITH, Instructor in Agriculture, New Plymouth (Chairman of the Farm Committee).

THE policy of reducing the arable cropping area at the Stratford Demonstration Area to a minimum and paying more care and attention to pastures and their management, as laid down some few years ago, was adhered to last season. Of the 140 acres comprising the farm only 4 acres were under the plough for the purpose of growing supplementary fodder. This area comprised 3 acres of mangels and 1 acre of carrots, which, owing to unfavourable spring and early summer weather conditions, gave yields below the average.

PASTURES.

Pastures made very favourable growth during the season, and the flush was such that despite a large area shut up for hay and ensilage it was necessary to use the mower to cope with the growth. Harrowing was carried out as time and opportunity occurred. There is no doubt that more harrowing should be done, but as regards this phase of pasture management we are more or less in the dark as to what constitutes the ideal amount. It is hoped that during the present season we shall be able to carry out some very definite experimental work with regard to harrowing, &c.

HAY AND ENSILAGE.

With the reduction of the area under supplementary fodder crop it was necessary to conserve a larger proportion of hay and ensilage than had yet been done. The making of ensilage plays a big part in the control of pasture growth, and in a good season for grass it naturally follows that an increased amount will be made. Fields 5, 7*d*, 14*a*, 15, and part of 16—a total area of 30½ acres—was harvested for ensilage, there being three stacks and one hillside pit. A special report has been prepared on the experience of the farm with the two methods—the pit and the stack. [See page 176.] Field 7*c*, and part of Field 16, totalling 15 acres, were used for hay.

RYE-GRASS AND CLOVER STRAINS.

With a view to determining which strains of rye-grass are the more permanent and which strains are likely to prove the most suitable in the Stratford district, an area of 4 acres was sown on the farm in the spring of 1929 with 200 plots, representing some fifty different strains. Included in the trial are all of the principal New Zealand strains, as well as certain commercial lines from overseas. The plots were top-dressed with various manures, so that some idea will also be obtained as to the behaviour of the various ryes under different manurial treatment. It is too soon as yet to report on the results of this trial, but it is hoped to conduct a field-day on the farm this spring, when the plots are showing up well.

A further area, 1 acre in extent, was sown with fifty plots representing twenty-five different strains of clover. These include most of our New-Zealand-produced red and white clovers, and also a number of both from overseas. As with the ryes, this experiment should afford some very definite local information as to the right types of clover to include in permanent grass mixtures.

PASTURE TOP-DRESSING TRIALS.

The various standard trials as laid down some years ago were continued during the season. The whole of the pastures were top-dressed about fourteen months ago, chiefly with slag. This season they are to be dressed chiefly with lime and superphosphate.

The chief trial carried out during 1929-30 was one with nitrogenous fertilizers. Part of this test had been in operation during the preceding year. At the beginning of the 1928-29 season Field 7, 10 acres in extent, was divided into two equal areas. One of these was termed the "nitrogen area" and the other the "phosphate area"; that is, one had nitrogen added besides the phosphatic dressings which both received. Both received identical dressings of phosphate, but the nitrogen area had nitrogen applied at varying intervals. An accurate record of all grazing was kept, as was also the milk-yield when the stock were on the different areas. While the grazing figures provide an accurate measure of the growth up to a point, the butterfat production cannot accurately be credited to the paddocks that the stock are actually grazing on when that milk is being produced, as there is a certain carry-over from paddock to paddock. The two paddocks were not merely grazed in rotation, but the cows were put into them when the grass had grown to what was considered the ideal stage for grazing. Thus it would be possible for one area to be grazed twice to the other's once, and so on. The actual top-dressing of the two areas during the first year (1928-29) was as follows:—

Nitrogen area — 3 cwt. basic slag	..	June, 1928.
1 cwt. sulphate of ammonia	..	July, 1928.
1 cwt. sulphate of ammonia	..	October, 1928.
1 cwt. sulphate of ammonia	..	January, 1929.
1 cwt. sulphate of ammonia	..	March, 1929.
Phosphate area—3 cwt. basic slag,		June, 1928.

The grazing is stated in terms of "cow-days," which represents one cow for so many days, or so many cows for one day. For instance, thirty cows in for three days would be ninety cow-days; the equivalent of ninety cows for one day or one cow for ninety days. The grazing and butterfat for the 1928-29 season were as follows:—

Nitrogen area — 296.6 cow-days	..	334 lb. butterfat per acre.
Phosphate area—301.3 cow-days	..	334.9 lb. butterfat per acre.

As indicated, the trial was continued during the 1929-30 season, when dressings were made as follows:—

Nitrogen area — 3 cwt. basic slag	..	June, 1929.
2 cwt. sulphate of ammonia	..	June, 1929.
Phosphate area — 3 cwt. basic slag	..	June, 1929.

The grazing and butterfat produced during the 1929-30 season, were as under:—

Nitrogen area — 344.7 cow-days	..	381.42 lb. butterfat per acre.
Phosphate area—294 cow-days	..	322.25 lb. butterfat per acre.

Taking the seasons individually, at first the ammonia appears not to have paid during the 1928-29 season, but the reverse was the case during the 1929-30 season. When going further into the figures, however, one finds that the nitrogen area produced a great deal more feed during the early spring months, when feed is much more valuable than later on. On the other hand, the phosphate area produced more later on, which evened the figures up. This shows the areas, so far as grazing days are concerned, on even terms, whereas the nitrogen area should show to advantage.

During the 1929-30 season Field 12, a 10-acre area, was divided into three equal parts, and one part treated with Nitrophoska, one with superphosphate, and one with Leunaphos. Nitrophoska and Leunaphos are two concentrated fertilizers manufactured on the Continent of Europe. Nitrophoska is a complete manure containing 16.5 per cent. nitrogen, 16.5 per cent. phosphate, and 20 per cent. potash, while Leunaphos contains 20 per cent. nitrogen and 20 per cent. phosphate. The amounts of all three fertilizers applied (Nitrophoska, superphosphate, and Leunaphos) were based on the phosphate content, so that all three areas got equal amounts of phosphate during the season, while the Nitrophoska and Leunaphos areas got equal amounts of nitrogen. The superphosphate area received its phosphate at one dressing, but the other manures were applied on four occasions. The dressings per acre were as follows: Nitrophoska, 1 cwt. in September, 1 cwt. in November, 1 cwt. in January, and 1 cwt. in March; superphosphate, 3 cwt. 24 lb. in September; Leunaphos, 90 lb. in September, 90 lb. in November, 90 lb. in January, 90 lb. in March. Grazing was carried out on the same lines as that on the other nitrogen area. The grazing and butterfat resulted as follows:—

Nitrophoska—	211.3 cow-days.	28.8 dry-stock days.	229.7 lb butterfat per acre.
Superphosphate—	211.2 cow-days.	60.3 dry-stock days.	244.7 lb. butterfat per acre.
Leunaphos—	189.5 cow-days.	4.6 dry-stock days.	224.2 lb. butterfat per acre..

While the results of this experiment are by no means conclusive, the indications are that the time has not yet arrived for general use of these concentrated fertilizers.

THE HERD.

Fifty-four cows were milked during the season, the average butterfat yield per cow, based on factory returns, being 321 lb. This is a decided increase on the figures of the preceding season, which were 308 lb. per cow. It is the intention of the farm committee to increase the herd during the current season by at least five head.

GENERAL.

During the year the manager, Mr. Strong, tendered his resignation, and Mr. C. Henderson was appointed in his place.

Farmers in the district are invited to make full use of the farm and visit it oftener. It is felt by the committee that a decided increase in membership of the Farm Society would do much to create active interest in the work, and with this in view a recommendation has been made to have the subscription reduced.

ENSILAGE-MAKING METHODS.

THE PIT COMPARED WITH THE STACK AT STRATFORD DEMONSTRATION FARM.

J. M. SMITH, Instructor in Agriculture, New Plymouth.

WITH a view to introducing the pit method of conserving ensilage a concrete hillside pit was built at the Stratford Demonstration Farm during the season of 1929-30. In common with the position on the majority of farms in the Stratford district, where the country is slightly broken, several suitable sites were available. The main points about a site for a hillside pit are, firstly, proximity to the paddocks where the crops are to be saved and to those where feeding-out is to be done; and, secondly, the securing of a hillside with sufficient depth and with good access and exit to and from the pit-bottom. This latter point is very important, as practically the whole of the carting out is done during the winter months, when, with heavy loads of ensilage, the cutting-up of the roadway will be considerable.

A very suitable site conforming to both of these conditions was selected on the farm. The area of land that can be called on to fill the pit is about 30 acres, while the pit-bottom strikes a conglomerate material that in itself makes a very suitable road. In this instance it was possible to have one road leading in and another leading out, both with good grades. The matter of having the two roads is not so important, provided there is sufficient room at the pit-bottom to turn and that there is a good grade out. The two roads are an advantage, however, as turning with a wagon at the pit-bottom means a good deal of wear-and-tear even on a well-metalled road. The advantage of having a pit built on a hillside is that it minimizes the actual handling of the green material and the finished ensilage. There is no undue lifting, as each operation means handling the stuff *down*. An opening, 4 ft. in width, the whole depth of the pit, with the exception of the top 4 ft., is left on the side of the pit looking out from the hillside, and through this opening the ensilage is taken out during the feeding-out process. During the filling of the pit the opening is boarded up as the pit is filled, the boards being rabbeted together and so made perfectly airtight.

CONSTRUCTING THE PIT SILO.

In building, the pit was first bored out to the prescribed size, which in this instance was a circle 20 ft. 8 in. in diameter to a depth of 14 ft. The walls were kept perpendicular. On the inside of the pit was built a wall or lining of concrete 4 in. thick. Only one set of boxing some 3 ft. in depth was required, which set completed a ring round the pit. No boxing is required for the back of the concrete as the solid earth wall is sufficient. Buttresses some 6 in. in thickness were built on either side of the opening to give strength to the structure, for at this point there is no earth wall to support the concrete; these buttresses are 3 ft. wide. No reinforcement was used, except for 10 ft. back on either side of the opening and for the buttresses. The pit was brought some 2 ft. 6 in. above ground-level, and a great deal of the spoil from

the excavations was used to form a ramp up to this height to allow the sweeps to work right up to the edge of the pit. The ramp was graded off to some 15 ft. back from the pit, and this rise of 2 ft. 6 in. in 15 ft. presented no difficulty for sweeping. A removable lean-to roof of wood and iron was constructed in three sections, and has a fall of 1 in 40. The sections were bolted to three plates, which in turn were bolted down to the concrete of the pit. Two men can remove the roof without great difficulty.

After due consideration it was decided to have the pit built by contract, and tenders were called for the job. The tender accepted was in the vicinity of £100, but this cost included the excavations and roof as well as the concreting. In most cases a farmer would do his own excavation work, and, provided he had the boxing, the concrete work would present no difficulty; so that a similar pit could be built at a much reduced cost.

MAKING THE PIT ENSILAGE.

A start was made with the filling of the pit early in December. The procedure followed was for one man to begin mowing when the others started milking in the morning, and to cut till breakfast-time. After the routine work, such as washing up and cleaning the milking-shed had been completed a start would be made with the ensilage. One man would operate the sweep, working so that he would bring in a load from near the pit and then one from much further afield. This gave the men at the pit more time to handle the material. A second man was stationed at the top of the pit, his duties being to pull the sweep load to pieces and fork it into the pit. From the top of the pit where the sweep left the load it was possible for this man to feed the green material right to the builder, and this saved a further man in the pit. The builder, receiving the material in small forkfuls, was able to make a good job filling, and the material was evenly distributed—not in rolls as one sometimes sees it. Careful building in the pit is just as essential as it is in the stack, if first-class ensilage is to be made. The centre of the pit was kept high in building, and due attention was given to the walls. Filling was commenced on 9th December, and continued on the 16th, 20th, 24th, and 27th, from 5 ft. to 6 ft. of material being put in on each occasion. When the last lot of green material was added the mass was some 6 ft. above the top of the pit, and it was nearly a fortnight before it had subsided enough for the roof to be put on.

The top of the ensilage was not weighted in any way, although it is common practice to put about a foot of soil on, as is done with ensilage stacks. The idea was to determine just how much waste would occur without any weight, and to get some idea as to whether the labour incurred in topping would be compensated for in the reduced waste that should occur. Taking everything into consideration, the result of this trial proved that leaving the stack without any weight is not a payable proposition. The waste on top averaged about 6 in. all over, which would represent about 3 tons of ensilage, while to the depth of about 2 ft. the ensilage ranged from dark to light brown, which is of slightly inferior quality to the green. Below this depth the ensilage was of splendid quality, being almost as green as the day it was saved and slightly sour.

STACK MADE FOR COMPARATIVE PURPOSES.

In order to get some idea of the saving effected by the pit silo as against the stack method of conserving in regard to labour, waste, &c., a stack was built in an adjacent paddock at the same time as the pit was being filled, and all details of labour, &c., were accurately kept. This stack was commenced on 14th December and completed on the 23rd, after six days' building. As against three men employed on the pit it was necessary to have four men and a boy working on the stack—one on the sweep, one at the stack-bottom, two on the stack, and a boy to lead the horse of the hoist. The size of the stack was 18 ft. by 20 ft., and was 6 ft. in height when it had finally settled down. The estimated weight of ensilage in the stack was 50 tons, as against 85 tons in the pit. The actual time worked on the stack was 150½ hours, while the filling of the pit occupied 125 hours. The boy's labour for leading the horse was reckoned as half of that of a man. Basing the labour at 2s. 6d. per hour the cost of labour for the stack was £18 16s. 3d., or 7s. 6d. per ton, as against £15 12s. 6d., or 3s. 8d. per ton, for the pit. The number of hours for the pit includes the time estimated for topping up with soil, had this work been carried out. Assuming, then, that the stack contained the same quantity of ensilage as the pit—85 tons—the total labour cost would then be £31 17s. 6d. for the stack and £15 12s. 6d. for the pit, or a saving of £16 5s. in favour of the pit. In addition to this no allowance has been made for the extra horse that was required for the purpose of working the hoist.

[ADVANTAGE LIES WITH THE PIT.]

The actual waste on the stack was 1 ft. deep on all the walls and about 1 in. at the top. This estimate of wall wastage is on the conservative side. The wall wastage in the pit would not exceed 2 in., and as labour for topping up has been reckoned in the case of the pit it is only fair to assume that the wastage would have been the same as that of the stack—namely, 1 in. on top. Reckoning the weight of ensilage at 45 lb. to the cubic foot, it is found that the total waste in the case of the stack is 9 tons 15 cwt., or 19.5 per cent., while in the case of the pit it is 3 tons 8 cwt., or 4 per cent. Again, assuming that the stack contained 85 tons, the waste could be reckoned as 16½ tons, as against 3 tons 8 cwt. for the pit. Putting the conservative value of £1 per ton on the ensilage, the value of the waste material in the case of the stack would be £16 10s., as against £3 8s. for the pit, or a saving of £13 2s. on the pit. Thus the total saving in favour of the pit is £16 5s. for labour and £13 2s. for wastage, a total of £29 7s. As an offset against this could be reckoned interest on the capital cost of the pit—say, £7—and depreciation—say, £2—leaving a net saving of £20 7s.

Thus it will be seen that, given a suitable site, the construction of a pit is a very payable proposition. In addition to the actual saving of over £20 there must be reckoned the ease with which the material is handled—less human energy being required—and the fact that building in the pit presents no very great difficulties, also that once the ensilage is saved it can be kept indefinitely in the pit.

IODINE CONTENT OF SOME NEW ZEALAND PASTURES.

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EXISTING data on the iodine content of New Zealand pastures are still very meagre. That the iodine content varies in pastures grown on different soils and in different parts of the country and throughout the year is evident from a study of the work already done (Hercus, Benson, and Carter, *Journal of Hygiene*, Vol. 24, December, 1925, and Hercus and Roberts, Vol. 26, March, 1927). With a view to accumulating further data for use in advisory work on the use of iodine in manuring and in the feeding of live-stock, the Department of Agriculture has been collecting and analysing pasture samples from various sources during the past year. Results from some of this work are here briefly recorded in the form of notes and graphs.

Graph 1 shows the seasonal variation in the iodine content of some pasture samples from Fendalton, Christchurch. It will be seen that the maximum point for this pasture is in July and the minimum in December. The maximum does not occur at the same time of the year in all areas, nor will it occur at the same period every year on the same area unless the climatic conditions are the same.

Samples from a hill pasture at Karori, Wellington, taken throughout the year, gave the results shown in Graph 2. It will be seen that the maximum is in the autumn and early winter, and the minimum in the summer.

Taking the Christchurch graph as a standard for comparison, the iodine content of the following samples may be of interest:—

At Taita, in the Hutt Valley, near Wellington, the pasture on a cow paddock in April had 70 gammas* per 100 gammas of dry weight, and in June the same. This is well over the Christchurch samples for April, but not so high as the Karori hill pasture in April. The hay paddock on the same farm in April had 86 gammas, in June 57, in July 72, and at the end of September only 30 gammas.

On Gear Island, Petone, at the mouth of the Hutt River, in June the pasture had 40 gammas, in July 45, in September 60, and in November it fell to 27 gammas.

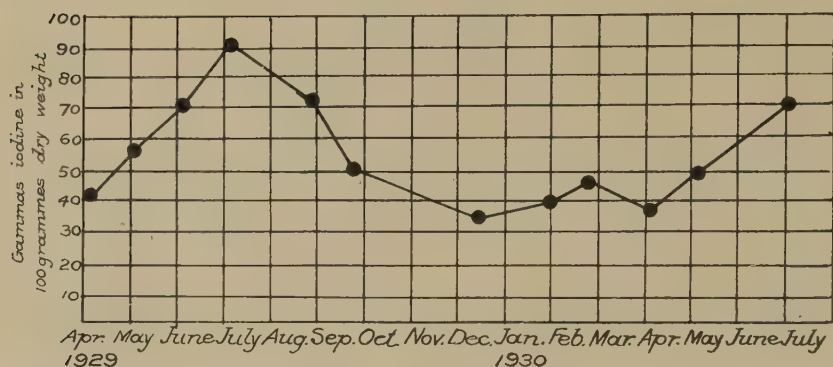
A sample from Inglewood, Taranaki, had 77 gammas, one from Wanganui 68, another from Halswell, Christchurch, 36, and a fourth from Ohau, Horowhenua, 36 gammas, all being sampled in April.

Pastures from Dargaville, North Auckland, had in May 94 gammas (this was mostly cocksfoot), in June 57, in July 133, and at the end of August 56 gammas.

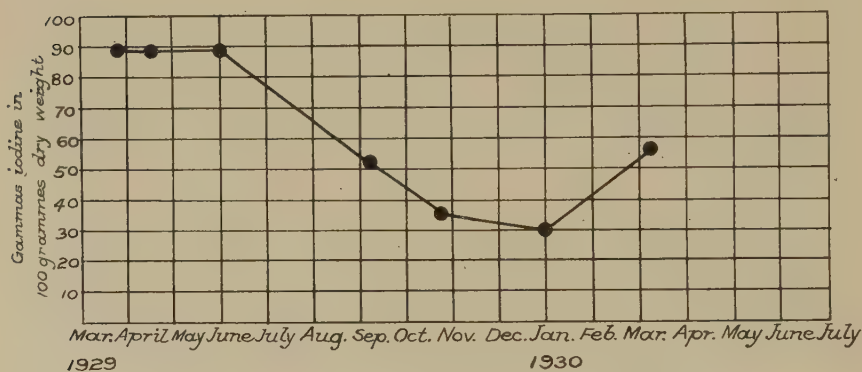
Heathcote pastures in June had 51, and in September 33 gammas, while one sample from the Cashmere Hills had in June 64, and in September 41 gammas. Both these localities are near Christchurch.

Six pasture samples from South Auckland areas, where sterility and eclampsia occur in stock, gave the following figures in September: Newstead, 28; Ruakura, 41; Koromatua, 49, 28, and 65; Taupiri, 40 gammas.

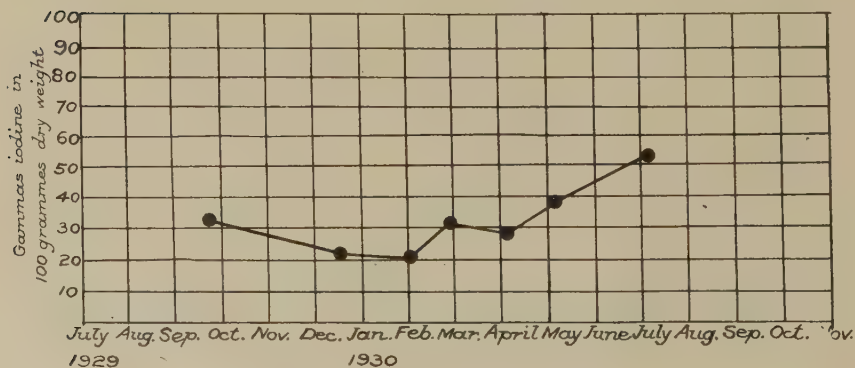
* A gamma (γ) equals one-millionth part of a gramme.



GRAPH 1. SHOWING SEASONAL VARIATION IN IODINE CONTENT OF PASTURE SAMPLES FROM FENDALTON.



GRAPH 2. IODINE CONTENT OF KARORI HILL PASTURE.



GRAPH 3. IODINE CONTENT OF TAI TAPU PASTURES.

Eight pastures from Otago, sampled at the end of October and the beginning of November, gave 27, 40, 65, 43, 54, 32, 25, and 19 gammas respectively.

Wanaka and Makarora samples taken at the beginning of November gave 32, 14, 32, 11, 13, and 17 gammas, while a Lincoln sample, also taken in November, gave 96.

Pastures from Hawera, sampled in August and October, gave 55 and 47 gammas respectively.

Tai Tapu pastures sampled throughout the year were of peculiar interest because they showed such a slight variation, the minimum being at the end of January and the maximum in July. This is shown in Graph 3.

Whangarei samples were also of comparative interest. These were not taken periodically from the same places, but are general samples taken at various times of the year from different places in the Whangarei area. Results were as follows: Golf-links (10/6/29), 101 gammas; Maunu (13/6/29), 164; Maunu (9/7/29), 191; golf-links (15/7/29), 70; golf-links (22/8/29), 153; general pasture (21/9/29), 157; hill pasture (28/11/29), 91 gammas.

Four Gisborne pastures sampled in January gave 45, 54, 39, and 41 gammas respectively.

GENERAL.

A systematic investigation of the iodine content of New Zealand pastures might be of some help in the solution of such problems as the distribution of endemic goitre and the seasonal occurrence of certain deficiency and other diseases in cattle and sheep.

Some figures may be quoted from the literature on nutrition for comparison with New Zealand figures. In Scottish pastures amounts of iodine range from 26 to 200 gammas per 100 grammes of dry matter. In English pastures the range is from 21 to 500 gammas, and in the United States of America from 0.2 to 17 gammas. Both in Scotland and in New Zealand the iodine content has been found to be highest in autumn and winter.

It should be noted that contamination of soil is sometimes difficult to avoid when sampling pastures, and, as the iodine content of soil is generally very much higher than that of pasture, the figure representing pasture iodine may not always be very accurate.

The method used for the estimation of iodine in the pasture samples here quoted was the titrimetric method of von Fellenberg, as used by Leitch and Henderson and modified in certain details. An amount of 10 grammes was ashed, extracted, and oxidized in the usual way. For titration four aliquot portions (5 c.c.) from a volume of 25 c.c. were taken; to these were added one drop of NH_2SO_4 and one drop of a saturated solution of bromine water; this volume was then boiled down to 1.15 c.c., and cooled and titrated with N/500 thiosulphate, after adding one drop of a potassium iodine solution and one drop of a starch solution. The blue colour disappears completely when excess of thiosulphate is added, but comes back on standing if too little has been added.

The Department expresses its indebtedness to those officers who sent pasture samples for analysis, and also to Messrs. Hounsell, Whangarei; Harding, Dargaville; Lysaght, Hawera; August, Taita; Lee, Gear Island; Newcombe, Karori; Wall, Ohau; Royd, Fendalton; McComb, Christchurch; Morgan, Tai Tapu; and Miss Kidson, Christchurch.

THE MANAWATU - WEST COAST FARM COMPETITION.

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As a result of the official advocacy of improved methods of farming, leaders of the farming and business communities of the Manawatu - West Coast district commenced to ask themselves the following important questions: (1) Are the potentialities disclosed by the practices of successful progressive farmers commonly known? (2) Is not emphasis at times being placed unduly upon certain phases of agriculture which promise development, while at the same time other phases which have greater promise are being somewhat neglected in popular attention?

A meeting representative of all interested sections of the community was convened a few months ago at Palmerston North by the Dairy Farmers' Union to discuss these questions. At this meeting it was established—(1) that the results obtained by certain farmers indicated potentialities for greater and cheaper production in farming generally; (2) that the lessons to be gained from the results of successful progressive farmers were not being taken advantage of generally, because there existed no means of readily directing public attention to them; (3) that it is in the interest of farmers, and also of those responsible for the finance of farmers and of those trading with farmers, that the potentialities for greater and cheaper production be fully understood in order that they be better exploited. It was thought that a suitably designed farm competition would be of much value in directing public attention and study to such potentialities, and it was decided to inaugurate such a competition without delay.

The work of designing and conducting a suitable competition was allotted to an executive committee consisting of the following, who are delegates of the bodies mentioned after their names: Messrs. N. Campbell, chairman (Dairy Farmers' Union), D. Collis (Manawatu and West Coast A. and P. Association), A. Dear (New Zealand Farmers' Union), W. H. Gimblett (Manawatu Herd Testing Association), M. H. Oram (Palmerston North Chamber of Commerce), R. P. Connell (Department of Agriculture), W. J. Croucher (Manawatu branch of the New Zealand Pig-breeders' Association), T. Ranford (Manawatu - West Coast Dairy Companies' Association), and J. H. Mason (dairy breed associations).

Details of the competition formulated by the executive committee follow.

(1) *Scope*.—The competition is open to owners or occupiers of farms fulfilling the following conditions:—

(a) Farms situated within that part of Wellington Province bounded by the Rangitikei River on the north, the Ruahine and Tararua Ranges on the east, and the coast-line for the remaining boundary.

(b) Farms of 30 acres or more in area, of which at least 50 per cent. of the income is derived from dairy products, including milk, butterfat, pig and poultry products, and calves and other stock bred in connection with dairying.

(c) Farms on which at least 80 per cent. of the dairy stock are on the farm all the year round.

(2) *Judging*.—The judging is to be done by a judging committee of four consisting of a practical farmer, a land valuer, an accountant, and a representative of the Department of Agriculture. This committee will carry out all necessary valuations and visit the competing farms several times during the currency of the competition.

For the year 1930–31 competition the judging committee consists of Messrs. D. Collis, Kairanga, farmer; Oscar Monrad, Palmerston North, land-valuer; R. H. Spencer, Palmerston North, registered accountant; and R. P. Connell, Department of Agriculture.

(3) *Scale of Points*.—For the guidance of the judging committee the following scale of points has been adopted:—

(a) Cost of production: Allotted 35 per cent. of total points. The cost of production of butterfat would be worked out. The monetary results of other lines—such as pigs, sheep, or poultry—would be debited or credited to the Butterfat Account as demanded by the nature of these results.

(b) Total production per £100 invested: Allotted 35 per cent. of total points.

(c) Stock: Allotted 20 per cent. of total points. In this section all types of stock would be considered, and particular attention would be given to such matters as their yields, their breeding, herd-testing, and provision made for additions.

(d) Farm goods and equipment: Allotted 10 per cent. of total points. Under this section would fall farm buildings, yards, water-provision—their suitability and upkeep; implements—their suitability and care; reserves of ensilage, hay, roots, &c.

(4) *Competition Prizes*.—The following schedule was adopted: 1st prize, £25, and £5 in value of suitable cup; 2nd prize, £15; 3rd prize, £5. It was further decided that there should be a minimum of ten entries or no first prize, six entries or no second prize, three entries or no competition.

(5) *Confidential Nature*.—Information required from competitors to be treated as strictly confidential.

(6) *Period*.—The competition to commence on the 1st July, 1930, and to extend over a period of one year.

GENERAL FEATURES OF THE COMPETITION.

The limiting of the competition to farms "of which at least 50 per cent. of the income is derived from dairy-products which include milk, butterfat, pig and poultry products, and calves and other stock bred in connection with dairying" makes the competition essentially a dairy-farmers' one. At the same time, however, it is left open in a very

desirable way to farmers who are exploiting in a substantial manner other lines such as sheep, pigs, and poultry. This is in keeping with the aims of the promoters of the competition, who desire information about the development of side-lines which are fitted to give either more effective use of dairy by-products or more effective production and utilization of crops. For instance, it is considered that a point worth studying is whether the strong development of a side-line leading to the profitable employment of more labour facilitates the production of extra feed for dairy cows at critical periods, and thereby improves the general efficiency of the farm.

The allotting in the scale of points of 70 per cent. of the total points to matters to be considered under the headings "Cost of Production" and "Total Production per £100 invested" means that the competition awards will be decided essentially on economic considerations, since the matters falling under the headings mentioned will, when considered jointly, give a comparatively thorough indication of the financial results being obtained by a farm. In other words, the scale of points was drafted specifically for the purpose of giving weight to farm-management results as distinct from farm-method results. This was done because while farmers may ask how to grow a crop they also rightly may ask whether they should grow it at all. The second question may on occasions be a more important one than the first—that is to say, the farm-management problem may be the more important consideration. As management efficiency is reflected in the farm's economic position, prominence has thus been given in the scale of points to the directly economic considerations.

In conformity with the fact that the competition awards will be decided mainly on economic considerations, the aim has been to provide that the judging will be carried out in such a way that—

(1) Success in award will not go necessarily to the farm which is "model" in layout, upkeep, and appearance. Money spent in obtaining "model" characteristics will be a handicap rather than an advantage in the competition unless the expenditure is adequately reflected in the returns. The competition does not aim to foster overhead non-productive expenditure.

(2) Success will not go necessarily to farms operated on high-quality soil. Careful farm valuation will be made. This will have a direct bearing on the cost of production and the total production per £100 invested—two items which weigh so heavily in the scale of points. It is quite conceivable that the winning farms will be well-farmed ones on relatively poor country.

(3) Success will not go necessarily to the farms with the herds of highest production—such production may be obtained at too great a cost.

(4) Success will not go necessarily to the farm showing lowest cost of production, because this may be secured by undue restriction of output, and at the expense of total possible net profit. Increasing the cost of production may increase the total profit, and this is usually more desirable than mere low cost of production. This is exemplified by considering two 50-acre farms, one of which produces 7,500 lb. of

butterfat at 12½d. cost per pound, while the other produces 10,000 lb. butterfat at 13d. cost per pound. With butterfat selling at 1s. 3d. per pound, the farm with the higher cost of production is the better financial proposition.

(5) Success will not go necessarily to the farms showing highest production per acre. This may be obtained at too great a cost. A production of 300 lb. butterfat per acre may not be as desirable as one of 250 lb., because of the excessive cost of producing the extra 50 lb. of butterfat. The competition is designed to secure data on such matters.

(6) Success will not go necessarily to the farmer who has a large family able and willing to work for him without wages, thereby eliminating the necessity for the bringing-in of outside labour. Family labour will be charged for at reasonable current rates.

(7) Success will not go necessarily to the farmer who fails to incur reasonable expenditure such as is entailed in top-dressing, herd-testing, &c., in order to keep down production costs for the period of the competition. In the judging, what the farmer does not do and should do in the interests of economic farming will be considered as much as what he does do. Hence, what the farmer who skimps in necessary expenditure gains in one way he will be very likely to lose in another way. In brief, a farmer may be inclined to set himself the task of winning the competition by avoiding outlay on practices or improvements that are in the interests of permanent good farming. He should remember that his acts of omission may be found more to his disadvantage than to his advantage.

(8) Success will not go necessarily to those who attempt to take undue advantage of past efforts. For instance, a man may carry over into the competition period large reserves of hay, ensilage, roots, &c. If these are used during the competition period, then their equivalent in similar reserves or in cash allowances must be provided at the completion of the competition.

The executive committee sought the funds for conducting the competition from farming and business organizations which are directly interested in the growth and spread of knowledge of improved farming, and gratifying financial support has been obtained from these sources.

Competitors were charged an entry fee of 5s. each, and twenty-five entries were received for this year's competition, which is now under way. Many of those who have entered are known to be unusually successful farmers, and thus the comparative study of their methods and results, for which the competition calls, promises to be productive of interesting information.

It is the opinion of the executive committee that the public attention which should be attracted by the competition will be materially increased as a result of the fact that Lord Bledisloe has graciously accepted the position of Patron of the competition. This patronage, which is in keeping with His Excellency's close interest in rural affairs, will thereby add to the general value of the competition.

MANAGEMENT OF CALVES ON THE DAIRY FARM.

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A GOOD start in life is of great importance to animals which will later form the dairy herds, and it is pleasing to observe that many dairy-farmers now pay much attention to the feeding and care of their calves. In many cases, however, improved practice and more knowledge are still necessary. It is with the object of providing some seasonal hints on the subject that the following notes are contributed.

ACCOMMODATION.

On some farms conditions are naturally favourable, in others artificial provision must be made. Newly-born calves in the winter and spring must be housed, and probably the best thing is a shed open to the north and admitting sufficient air and sun, with a dry earth floor which can be bedded down. The bedding should be removed and renewed sufficiently often to preserve cleanliness. If calves are tied up for a time after feeding the tendency to suck each other is lessened. Later on they may run at grass, and if a shed as described is available they will take advantage of it at night and in wet weather.

The calf-paddock should be dry and well drained, with good-quality pasture, and sheltered by a close-bottomed hedge from prevailing winds. In the spring shelter helps to save feed which would otherwise go to maintaining body-heat. Too often one sees calves turned into some cold wet gully simply because it is unfit for anything else. Where hedges are absent some kind of artificial windbreak should be provided. When the pasture becomes too long it should be eaten down by the dairy herd as required. A calf-paddock should not be in use as such for more than two seasons without a twelvemonths' break. Apart from bacterial contamination, it eventually becomes infected with the larval forms of parasitic worms, which take months to die out. Thorough harrowing and liming may reduce these pests to a slight extent.

FEEDING.

The young calf should be fed three times a day, though this is seldom done except with valuable stock. The beastings or colostral milk should be given to the new-born, as it has a laxative effect and contains certain protective substances. Many now leave the calf with the mother for the first two days, which is not only best for the calf, but gives less trouble than might be anticipated. As to the amount, the tendency is to overfeed, which should be guarded against. Probably 5 lb. to 6 lb. of milk daily, increasing to a gallon (10 lb.) within the first fortnight is sufficient for Jersey calves. Very convenient calf-bails are now in general use. Feeding-places may with advantage be concreted. Strict cleanliness by scalding of all food utensils is important.

The milk should be fed as near blood-heat as possible. Benefit results from diluting the allowance of milk with 10 per cent. of lime-water and occasionally adding a pinch of salt. It is now recognized

that certain types of acute indigestion may be due to feeding a milk high in solids not fat, and the lime-water serves to reduce this high concentration and render the curd more digestible. The longer the calf can get whole, non-separated milk the better; but as a rule, after three to four weeks this is reduced and replaced by skim-milk to an increasing extent. Usually at this stage the calf is already picking a little grass.

Calves are sometimes raised satisfactorily on whey after the first four to six weeks, provided good grazing and an allowance of concentrates is made. Meat-meal is a valuable supplement to whey, a suitable ration being about $\frac{1}{4}$ lb. daily for calves three to four weeks old. Calves will early take to concentrates, and if a little dry bran and pollard, linseed-meal, or crushed oats is put out just after the milk, it lessens their tendency to suck each other. They will start taking this at three to four weeks old. Where good pastures are available, concentrates may not be necessary.

WEANING-TIME.

Weaning-time is frequently a critical stage. Where the young calf during most of its life has had suitable grazing and has been utilizing this it does not feel the loss of the milk to any extent. Unfortunately, weaning-time frequently coincides with a reduction in the milk-supply due to a drying-up of pasture, and here is where the advantage of some previous education in feeding on concentrates may be felt, as these may be continued a little longer and tide the calf over a period of shortage of grass. The provision of fresh young pasture at a proper stage is relatively as important to calves as to cows in the height of production. During the autumn and winter months good-quality hay should always be available, and may be supplemented with roots, ensilage, or whatever else is on hand. The provision of rock salt or a lick containing bone-meal, salt, iron, and iodine, is being increasingly followed and is undoubtedly valuable.

The age at which weaning takes place often varies. One progressive Waikato farmer finds that with July calves three and a half to four months is a very suitable time. This seems a somewhat early age, but he finds that by weaning at this period of the year, calves are able to go on to the grass while it is still young, growing, and palatable, and that they get well established before the dry period sets in. With late calves, of course, this advantage could not be secured. If young grass or turnips and grass are available, such will be an excellent wintering place for calves, for the reason, as will be discussed later, that it is clean ground free from parasitic infection, and parasites are believed to be the cause of much of the unthriftiness seen in young stock about nine to twelve months old.

DISEASES OF CALVES.

With the exception of blackleg, probably 90 per cent. of the troubles affecting calves and causing either death or serious loss of condition may be put down to one of two causes—defects in feeding, and parasitism. The comparative importance of these causes varies inversely during the first year, digestive troubles being most important during the first three or four months, and later on parasites. It must

not be overlooked that the animal which has been imperfectly nourished is also more likely to fall a prey to invading parasites.

Scours or Diarrhoea.—An infectious disease of this type exists and may attack calves within the first forty-eight hours after birth, but it is doubtful if this exists in New Zealand, and the trouble is usually met with in calves between two and three weeks and up to two months old. The animal purges freely, the dung being liquid and whitish or greenish, depending on the amount of grass being eaten. The calf rapidly loses condition, becomes weak and sunken-eyed, and is indifferent about feeding. In severe cases blood may appear in the droppings. The cause is primarily indigestion, which may be set up by dirty feed-tins, milk too rich, in too great quantity, or given cold; or, in older calves, by too much soft green grass.

For treatment of this trouble all milk should be stopped for twenty-four hours, allowing only boiled water with teaspoonful of salt. If necessary a small dose may be given—say, four tablespoonfuls of raw linseed-oil with a teaspoonful of turpentine and two of baking-soda. Usually this is all that is required, and the calf may be gradually brought back to milk well diluted with lime-water. In more severe cases a teaspoonful of chlorodyne may be given in water, and frequent dessertspoonful doses of a powder containing equal parts of baking-soda and bismuth carbonate. With older calves, where grass is too long, it should be eaten down by older stock or the calves moved to barer pastures. The calves should be nursed according to the weather, and not hustled about unduly in their weak state.

Acute Indigestion or Staggers.—Occasionally a big thriving calf may suddenly develop an attack of rushing about, bellowing, possibly falling down in a fit, and may die suddenly. Post-mortem examination usually reveals nothing beyond a mass of very tough curd in the stomach. Treatment by a small dose of Epsom salts and baking-soda may be tried, but frequently fails. However, this trouble should be avoided by diluting the milk as previously recommended.

Parasitic Gastritis.—This is due to the presence of small worms in the fourth stomach. The worm-eggs discharged on the ground in the droppings of affected calves hatch out, and the minute forms remain in the pasture, capable of infecting other calves for months, hence the necessity for occasional changes of calf-paddock. Dampness favours them and longish pasture grass gives more cover, hence the disease is more noticeable after a wet summer. The symptoms may appear shortly after weaning, or at any time during autumn or winter. Affected calves are unthrifty, lose condition, frequently scour, and become weak, sunken-eyed, and pale in the lining membranes of the mouth, nose, and eyelids. Usually a number are affected at once. In older calves the unthriftiness alone may be evident. The carcass of a calf dead from the disease is emaciated, pale, and bloodless. Owing to the minute size of the worm most commonly responsible, examination of the lining of the wall of the fourth stomach may not always reveal the cause until a scraping from the lining is examined under the hand-lens or microscope.

For treatment the calves should at once be dosed with some reliable worm medicine such as 3 oz. to 4 oz. of a 1-per-cent. solution of blue-stone given after fasting twelve hours. It may be necessary to repeat

this twice at ten-day intervals. Two days after drenching the calves should be moved to fresh grazing, preferably short, and everything done to support condition, such as provision of good hay, small quantities of some concentrate, and either rock salt or a compound lick provided. Recovery is a little slow. Commercial Parrish's Food is a useful tonic for valuable calves.

Prevention consists in the provision of clean grazing-grounds for calves each year. On badly affected farms probably routine drenching once every three weeks, commencing before weaning, would enable calves to go through without showing symptoms. Keeping no calves at all for twelve months might allow infection to die out, but it must be remembered that yearlings may harbour the worm without showing symptoms; moreover lambs are also the hosts of one or two of the worms found in calves, and the grazing of affected lambs on dairy-farms may be a means of introducing parasites.

Lung-worm, or Hoose.—In this trouble the parasite is in the wind-pipe and smaller bronchial tubes of the lungs. The chief symptom is a persistent harsh cough affecting a number of calves, and best noticed when they are first stirred up. Otherwise, much that was said under the heading of parasitic gastritis applies to this trouble. Treatment by drenching is of little value, and injections of turpentine, chloroform, and other substances directly into the windpipe is the only reliable method of attacking the parasite. Good feeding may enable the animal to throw it off.

Redwater.—This has been seen in calves from three weeks to as many months. The first symptom, the passage of dark-red urine, may be overlooked, and the calf soon becomes weak, refuses food, and dies in forty-eight hours or less. On post-mortem examination the carcase is pale and bloodless, and the liver dark, becoming orange on exposure. Any urine in the bladder is dark red. Usually a number of calves are affected. The cause is apparently dietetic. For prevention the best results seem to be from well diluting the milk with lime-water and adding a little salt—say, a teaspoonful per calf daily. In treatment a teaspoonful of common salt plus 10 grains of sulphate of iron, in $\frac{1}{2}$ pint of milk, together with a dessertspoonful of turpentine, is recommended.

Blackleg.—This is due to a germ present in the soil in certain localities. The disease usually attacks the most thriving animals at from three months up to two years, rarely older, and most cases are in calves about six months old. The affected animal may be simply found dead, or it may be noticed sick and lame with swelling of the shoulder or quarter. The swelling has a tense feel, and gives a drum-like sound, due to contained gas. Treatment is hopeless, and animals dead of the disease should be deeply buried without opening, to prevent the spread of the infection. Inoculation of susceptible animals gives an immunity lasting over the most dangerous period, and this work has been carried out by the Department of Agriculture free of cost for many years in certain affected districts.

Actinomycosis.—This is a disease sometimes seen in calves which have been wintering on swampy country, and rarely it occurs in younger animals. The usual symptom as regards the latter is the appearance of one or more swellings the size of an orange in the throat region.

Later on the abscess ruptures and pus discharges. This condition is in most cases curable by the use of potassium iodide. As actinomycosis is one of the scheduled diseases any suspicious case should be notified to the nearest Inspector of Stock.

Tuberculosis may be present in calves, but it is very rarely that symptoms are recognizable.

Necrotic Infection of Throat.—A condition suggestive of acute sore throat, with a loud roaring sound during inspiration and much distress in breathing, is occasionally met in quite young calves. Cases investigated have been found due to infection in the throat by a common dirt germ, the bacillus of necrosis, which, incidentally, also causes foul-in-the-foot. Treatment has so far not proved successful, and affected calves are probably best destroyed at once, as they suffer great distress. Preventive measures should be directed towards greater cleanliness of yards and feeding utensils, though it must be admitted that this throat trouble has also been seen where hygiene was of a high order.

CONCLUSION.

In conclusion one may summarize: Keep the young calf warm; feed the young calf well, but not too well; feed the older calf better; provide clean grazing-ground; dose with a reliable worm remedy once a month where parasites are feared.

TESTING OF PUREBRED DAIRY COWS.

NEW C.O.R. CLASS-LEADERS.

Dairy Division.

It must be regarded as a remarkable achievement in the annals of New Zealand certificate-of-record testing that two cows commencing test in the same class in the same year, with a difference of only nine days in age and thirty-five days in calving, should supersede a class-record already held with a particularly high yield of butterfat. The two cows referred to are the Jerseys Cousin Grace and Ivondale Silver Rainbow.

COUSIN GRACE.

When Cousin Grace calved on 20th July, 1930, some 400 days after her date of calving for commencement of test, she completed her requirements for C.O.R. and at the same time qualified for the leadership of the three-year-old Jersey class. The previous holder was Mr. P. J. Petersen's Ivondale Golden Lass, with 905 lb. butterfat. Cousin Grace's final figures for the 365 days period were 14,957.6 lb. milk containing 935.21 lb. butterfat, the average test being 6.25 per cent. With the exception of seventeen days, she was milked three times a day throughout her testing period, and commenced test at the age of 3 years 318 days.

Cousin Grace is shown in the New Zealand Jersey Herd Book as having been bred by Mr. J. Shaw, of Paterangi. Her record, however, was made in the ownership of Mr. J. Bones, Kaipaki, Ohaupo, who is to be congratulated on the handling of this fine dairy animal. Cousin

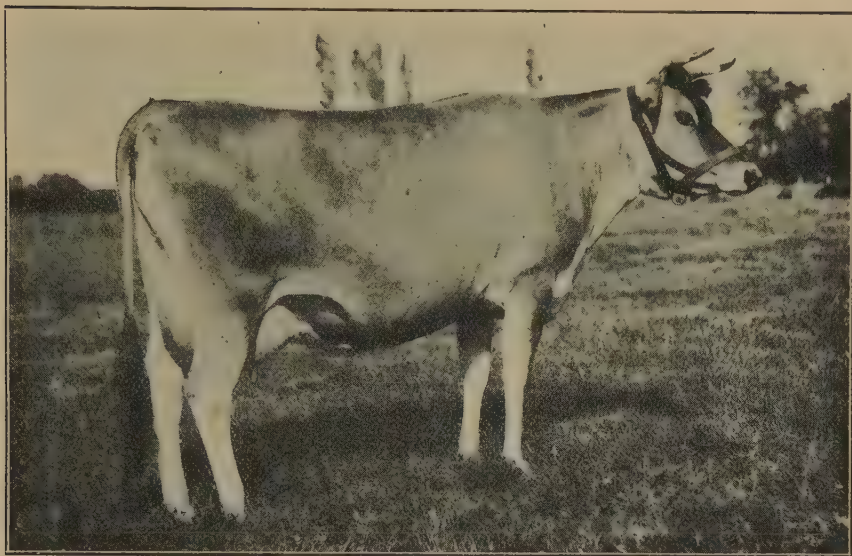


FIG. I. COUSIN GRACE (J. BONES, KAIPAKI, OHAUPO).

C.O.R. in Jersey three-year-old class : 14,957·6 lb. milk, 935·21 lb. butterfat.

[Dairyfarmer photo.]

Grace is by Distinction's Defender from Shalotte's Grace. The bull Roberts is prominent in the pedigree, and other names well known to our C.O.R. breeders are Maiden's Gay Lord (by the imported bull Maiden's Glory Lad), Silverlock's Duke, Twylish's Maid of all Work, and Brighton Twylish.

IVONDALE SILVER RAINBOW.

Cousin Grace held the leadership just six weeks. The honour then reverted to the previous holder, Mr. P. J. Petersen, when, on 30th August, 1930, Ivondale Silver Rainbow calved subsequent to test, after having placed to her credit a yield of 15,073·4 lb. milk containing 950·63 lb. butterfat, in 365 days, the average test being 6·30 per cent. This performance is all the more meritorious when it is considered she was milked only twice daily throughout the whole lactation period. She was 3 years 327 days old at date of calving for commencement of test.

Ivondale Silver Rainbow was both bred and tested by Mr. P. J. Petersen, of Brixton, Waitara, and a review of her extended pedigree would make very interesting reading were there space to deal with it fully. Running back some six or seven generations, the attention is immediately drawn to the variety of prominent individuals—variety, because, while almost every name is that of a maker of New Zealand Jersey history, there is little similarity or apparent system in the mating. The sire of Ivondale Silver Rainbow is Xenia's Oxford Lad (imp.), member of a prominent Jersey Island family. The dam is Ivondale Rainbow's Lass, who is also the dam of Ivondale Oxford

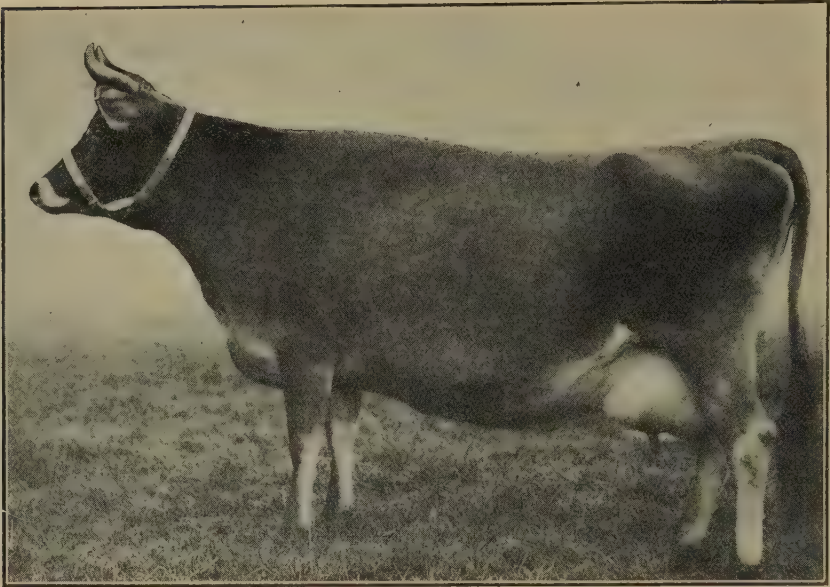


FIG. 2. IVONDALE SILVER RAINBOW (P. J. PETERSEN, WAITARA).

C.O.R. in Jersey three-year-old class: 15,073·4 lb. milk, 950·63 lb. butterfat.

[Dairyfarmer photo.]

Lass, present leader of the Jersey Junior two-year-old class. Running back on the dam's side, one finds Pride of Egmont, K.C.B., Doctor, Blizzard, Optician, Larkspur, Heather, and a number of others who laid the foundation of so many of our present-day champions.

Briefly summed up, it would appear that Ivondale Silver Rainbow is a fortunate combination of many of our best blood lines, and bearing in addition whatever influence may be due to a member (her sire) of one of Jersey Island's good families. Mr. Petersen's breeding still claims three of the five Jersey C.O.R. class-leaderships, which in itself is sufficient evidence of the outstanding merit of the Ivondale stud.

MAESGWYN VICTORIA.

The third new class-leader is also a three-year-old, but of the Ayrshire breed. Her name is Maesgwyn Victoria, and she was bred and tested by Mr. C. Morgan Williams, of Kaiapoi. She commenced test on 17th July, 1929, at the age of 3 years 250 days, and in 365 days produced 16,507·7 lb. milk containing 646·98 lb. butterfat, a record some 7 lb. higher than that of Mr. W. Moore's Fair Lass of Greenbank, the previous holder of the class-leadership.

The sire of Maesgwyn Victoria is Maesgwyn Victor, who on the male side traces back to Craigellachie, the sire of Alexandra of Waipapa, who at one time held the leadership of both the four-year-old and the mature Ayrshire classes. The dam of Maesgwyn Victoria is



FIG. 3. MAESGWYN VICTORIA (C. MORGAN WILLIAMS, KAIAPOI).

C.O.R. in Ayrshire three-year-old class : 16,507.7 lb. milk, 646.98 lb. butterfat.

Maesgwyn Clover (C.O.R., 386.17 lb. butterfat), and some three generations back one finds Auchenbrain Exchange (imp.), Dominion East Newton Beauty (an outstanding matron), and Dominion Netherton Good Bonus, who had a markedly beneficial influence on New Zealand Ayrshires. Dominion Newton Gipsy also appears. Auchenbrain Exchange (imp.) is a member of the celebrated Auchenbrain stud, which produced Auchenbrain Brown Kate 4th, at one time the world's champion Ayrshire cow. It may also be mentioned that Maesgwyn Hazel, who is Maesgwyn Victoria's granddam, gained a certificate on the highest milk-yield yet credited to a New Zealand C.O.R. Ayrshire—namely, 20,723.4 lb., with a butterfat-yield of 695.44 lb.

It is a pleasure to record this further success of the Ayrshire breed, and we should like to congratulate Mr. Morgan Williams upon the breeding and handling of Maesgwyn Victoria. From the illustration which appears in connection with these notes it will be seen that she is a splendid sample of the breed, showing true dairy type and strong evidence of sound constitution.

Utilization of Imported Fruit-case Timber.—Writing on this matter, Mr. R. G. Hamilton, Orchard Instructor for the Waikato district, remarks: "I notice that the roll-cut timber of the imported cases has been condemned because of its excessive pliability. Where the ordinary-cut timber is used on the bottoms, and the roll-cut timber on the top, the bulge is usually all at the top with none at the bottom. If, however, the roll-cut timber is used as bottoms and the ordinary-cut timber for tops a very fine package is secured, with an even bulge both top and bottom. A grower in the Auckland district happened to use all the roll-cut timber as bottoms, and the improvement was very noticeable. It makes a far more even package than where ordinary-cut tops and bottoms are used."

EXPERIMENTS ON TRANSMISSION OF DRY-ROT (*PHOMA LINGAM*) OF SWEDES BY INSECTS.

W. COTTIER, M.Sc., Entomology Section, Plant Research Station, Palmerston North.

THE present article is an account of preliminary experimental work carried out at the Plant Research Station, Palmerston North, with two insects characteristically found in dry-rot lesions, for the purpose of testing their capabilities in carrying the disease from infected to healthy swede bulbs. These two insects belong to the orders Coleoptera, family *Staphylinidae* (Fig. 1a), and Diptera, family *Drosophilidae* (Fig. 1b) respectively, and are in the hands of the Imperial Bureau of Entomology, London, for identification.

Neill (1929), in discussing the spread of dry-rot, stated that "a study of the spread week by week, and the obvious attraction to insects of spore-producing lesions, suggest very strongly that insect carriers are the main source of fresh infection." The primary infection comes through the seed.

Should one pull a dry-rotted bulb from the field there will usually be seen numerous small black insects running from the lesion (in which they breed) to the bottom of the swede and dropping off to the ground. These are the Staphylinid beetles referred to above, and as many as forty individuals may be taken from a single lesion. The persistent occurrence of these beetles in the diseased bulbs suggested that they may play a large part in the dissemination of the spores, more especially since they appear to fly only now and again, and their wandering from the diseased plant to others immediately in its vicinity could quite well account for the characteristic spread of the disease in circles from the centres of primary infection. Particulars concerning the life history of the dry-rot organism may be obtained from publications by Cunningham (1927) and of the spread of the disease in the field from Neill (1929).

The attraction of light for these beetles is very slight, and they prefer to hide in lesions rather than show themselves in the open; so that once having found safe harbourage in a rotted bulb their movement round this point would tend to be somewhat confined. That the beetles can find enough food on an apparently healthy swede has been demonstrated by the writer, who has kept them active and healthy under such conditions for two months. This shows, further, the probability of their wandering and feeding on healthy bulbs round the diseased one, using the dry-rotted swede for a base as it were. The fly used in these experiments was chosen because it breeds very abundantly and quickly in the rotted tissue of the swede.

No work was done on the method of carriage of the spore by the insect, the aim of these experiments being simply to discover whether the spores would be carried by this means.

EXPERIMENTAL PROCEDURE.

The swedes used were taken from a plot on the Station area. Dry-rot subsequently appeared in this crop in only one small patch, and this was approximately 25 yards from the spot where the bulbs

were selected. Fifteen bulbs were taken on 1st March, 1930, and each was kept for a considerable time under insect-proof conditions to allow any dry-rot that might be present to develop. Three weeks later between 60 and 70 more bulbs were taken from the same spot and again kept under insect-proof conditions to allow any disease to show itself. No dry-rot appeared in any of the bulbs prior to inoculation by contaminated insects.

The Staphylinid beetles were taken from lesions in the field and kept confined on moist rotting potato tubers for three weeks prior to use (excepts in Experiments 1 *a*, *b*, *c*, and *d*). The flies also were taken from lesions in the field and bred for a generation on rotting potatoes (except in Experiments 6 *a*, *b*, *c*, and *d*).



FIG. 1. THE TWO INSECTS EXPERIMENTED WITH AS DRY-ROT CARRIERS.
(*a*) Staphylinid beetle ; (*b*) Drosophilid fly. Both enlarged about 12 times.

[Original.]

At first, on account of their slight attraction to light, it was rather difficult to obtain a satisfactory means of transferring the beetles from diseased to healthy material. The method finally evolved was as follows: Strong cardboard collecting boxes, approximately 2 in. in diameter, fitted with glass tops, were used in two sets of six each. Every precaution was taken in disinfecting and in handling these boxes so as to prevent contamination by spores other than those carried by the beetles. For the most part six insects were used in each experiment. These were removed from the diseased material to a clean bench and a collecting-box placed over each. The insect in a short time had crawled up the inside of the box, which could then be lifted and closed by the lid. The other set of six boxes was kept on another bench, which, after six transfers, was thoroughly washed down with acidulated corrosive sublimate (1-500) and allowed to dry. The boxes (one during each transfer*) containing the beetles from the diseased material were then placed in the centre of this clean bench, with

* It must be clearly understood that there was only one box in the centre of the bench during the transfer of each beetle to a clean box.

the lid removed but still containing the insect. In all cases the two sets of boxes were manipulated by different hands. The box was then lifted and the insect allowed to run approximately 1 ft. from the spot, when it was covered by a clean box from the second set. This box was then closed and the beetle placed on a clean bulb. The operator's hands were at all times kept completely disinfected.

After each lot of six transfers each set of boxes was thoroughly cleaned with acidulated corrosive sublimate and allowed to dry. It was thought, however, after the first few experiments, that spores on the insect coming in contact with the dry corrosive sublimate would possibly be killed on being subsequently moistened. For this reason all later disinfections of boxes were carried out by heat. The same possibility of killing the spores existed in allowing the beetles to run on the dry bench after it had been washed down with corrosive sublimate. To obviate this difficulty two sheets of clean paper were used in each lot of six transfers; the beetles were collected from the diseased material on one sheet, the bench then being disinfected and the insects transferred to the other boxes on a second clean sheet. The bench was again disinfected ready for another lot of transfers.

As a rule transfer of the flies was an easy matter on account of their strong attraction to light, the insects being allowed to fly from the receptacle containing the diseased material to that containing the healthy bulb.

The apparatus used for confining each bulb under insect-proof conditions is shown in Fig. 2A. The swede (*a*) was confined in a Miller No. 3 lamp-chimney (*b*) resting in a receptacle (*c*) containing water. The apparatus was closed at the top by a fine muslin cover held in position by a strong rubber band. Inside the lamp-chimney the space between the bulb and the glass was packed tightly with cotton-wool to prevent the insects from reaching the water.

Several sources of infection were used—namely, (1) dry-rot bulbs from the field, (2) bulbs artificially inoculated with dry-rot strains IIA and IIB, (3) Petri dish cultures of strains IIA and IIB. The insect was allowed to feed on the well-infected bulbs, either in the apparatus shown in Fig. 2A or in a glass jar closed by a fine muslin cover.

To facilitate the handling of the flies on the culture plates a simple apparatus as shown in Fig. 2B was used. The culture plate (*a*) was inverted over one end of a glass cylinder (*b*) approximately 2 in. in diameter and 6 in. long, the end of the cylinder being pressed into the media on the plate. The other end of the glass cylinder was closed by a cotton-wool plug.

The apparatus was placed on a bench in the position shown in the figure, with the light coming directly from above. In this way the flies for the most part kept on the culture at the top. For transference the cotton-wool plug was removed, the apparatus inverted, and the insects carefully allowed to fly to a sound bulb. The beetles were easily confined on the culture in a Petri dish, the whole being kept in semi-darkness, and the insects transferred by the collecting-box method.

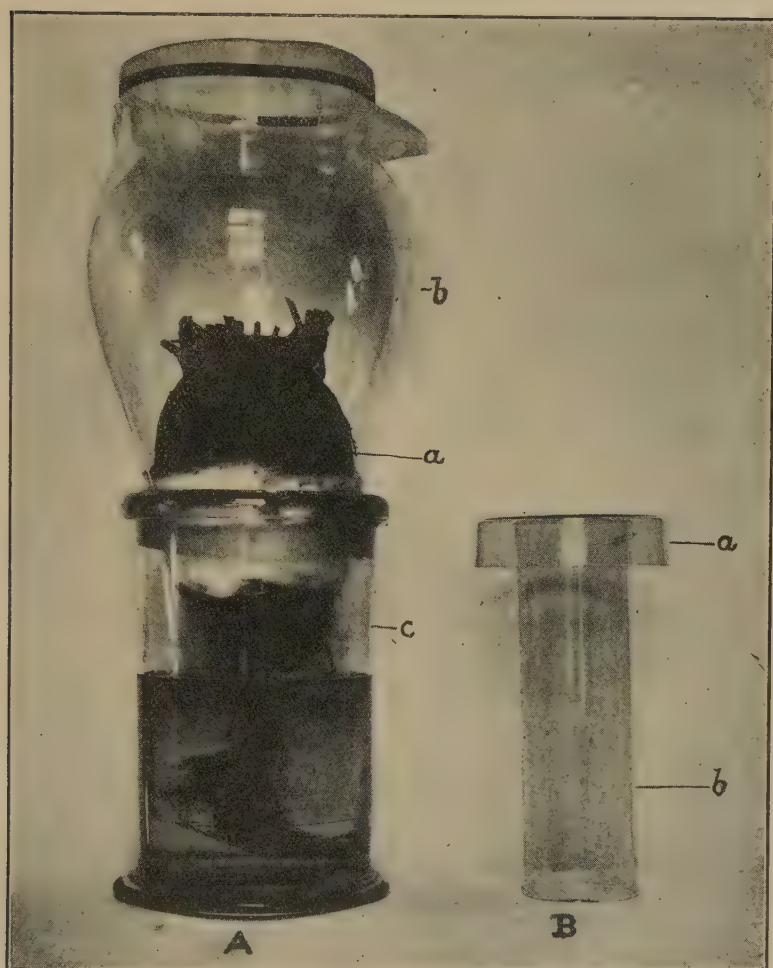


FIG. 2. APPARATUS USED (A) FOR CONFINING BULBS UNDER INSECT-PROOF CONDITIONS ; (B) FOR HANDLING FLIES ON CULTURE PLANTS.

For details, see text.

[Photo by H. Drake.

RESULTS.

Table I shows the results of the experiments with the Staphylinid beetle and the Drosophilid flies respectively. The controls for all these experiments are not shown in the tables, but they consisted of twenty bulbs taken at random from those collected in a block of between seventy and eighty mentioned in the section "Experimental Procedure." Each of the bulbs was kept separately under the same conditions as those upon which insects were placed, and none developed dry-rot. These twenty bulbs may be treated as controls for each of the ten sets

of experiments shown in the tables. The air temperatures in the glasshouse were 50° to 60° F. at night and 60° to 65° F. during the daytime.

Table 1.—Results of Experiments on Transmission of Dry-rot of Swedes.

Experiment No.	Source of Infection.	Number of Insects used.	Time on Source of Infection.	Number of Bulbs which developed Dry-rot.	Number of Bulbs which remained healthy.	Time taken for Disease to show.*	Time on healthy Bulb.
<i>Staphylinid Beetles.</i>							
Bulb 1a	Dry-rot lesion in field	6	..	..	I	..	1 day.
1b		6	..	..	I	..	2 days.
1c		6	..	..	I	..	5 days.
1d		6	..	I	..	28 days	7 days.
Bulb 2a	Plate containing culture of IIB dry-rot strain	6	1 hour	I	..	45 days	Not removed.
2b		6	4 hours	I	..	27 days	
2c		5	8 hours	..	I	..	
2d		6	5 days	..	I	..	
Bulb 3a	Plate containing culture of IIA dry-rot strain	6	1 hour	..	I	..	Not removed.
3b		6	4 hours	..	I	..	
3c		5	8 hours	..	I	..	
3d		6	5 days	..	I	..	
Bulb 4a	Bulb artificially inoculated with dry-rot strain IIB	6	1 hour	..	I	..	Not removed.
4b		5	4 hours	..	I	..	
4c		6	20 hours	..	I	..	
4d		6	5 days	I	..	36 days	
Bulb 5a	Bulb artificially inoculated with dry-rot strain IIA	5	1 hour	..	I	..	Not removed.
5b		6	4 hours	..	I	..	
5c		6	20 hours	..	I	..	
5d		6	5 days	..	I	..	
<i>Drosophilid Flies.</i>							
Bulb 6a	Dry-rot lesion in field	6	Bred on source	..	I	..	1 day.
6b		6	"	..	I	..	4 days.
6c		6	"	..	I	..	5 days.
6d		6	"	..	I	..	7 days.
Bulb 7a	Plate containing culture of IIB dry-rot strain	5	1 hour	..	I	..	Not removed.
7b		8	4 hours	..	I	..	
7c		6	8 hours	..	I	..	
7d		6	30 hours	..	I	..	
Bulb 8a	Plate containing culture of IIA strain	6	1 hour	..	I	..	Not removed.
8b		4	4 hours	..	I	..	
8c		6	8 hours	..	I	..	
8d		6	2 days	..	I	..	
Bulb 9a	Bulb artificially inoculated with dry-rot strain IIB	6	1 hour	..	I	..	Not removed.
9b		6	4 hours	I	..	42 days	
9c		5	24 hours	..	I	..	
9d		6	Bred in bulb	..	I	..	
Bulb 10a	Bulb artificially inoculated with dry-rot strain IIA	6	1 hour	I	..	36 days	Not in-moved.
10b		6	4 hours	..	I	..	
10c		7	Bred in bulb	I	..	27 days	

* From time of placing insects on healthy bulb.

COMMENTS.

From an inspection of the table it will be seen that the percentage of bulbs that developed dry-rot is small, but taking into consideration

the fact that not one of the controls showed a sign of the disease and the care with which the work was performed, it is considered that evidence has been brought forward to incriminate both the beetle and the fly. The conditions under which the work was carried out were very artificial, and, furthermore, the time which necessarily elapsed between taking the beetles from the infected material and placing them on clean bulbs offered considerable opportunity for the separation of mechanically carried spores from the body of the insect. A larger series of experiments is in progress under conditions as natural as possible. These are designed to show further whether or not insects play a large part in the dissemination of dry-rot spores in the field.

The writer's thanks are due to Dr. G. H. Cunningham and Mr. J. C. Neill, Mycologist and Field Mycologist respectively, of this Station, for advice and help in planning and carrying out these experiments; also to Mr. R. Brien, Culture Specialist, who provided the plate cultures and inoculated bulbs and tested any dry-rot that developed.

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NEW DAIRY REGULATIONS.

A NUMBER of amendments and additions to the Dairy-produce General Regulations were gazetted on 7th August, 1930, and came into force on that date. The most important of these may be briefly summarized as follows:—

(1) The registration of a dairy company may be cancelled if, in the opinion of the Director of the Dairy Division, the quality of any dairy-produce manufactured or otherwise produced at such manufacturing dairy is intentionally made inferior to the quality that could be attained, having regard to all relevant circumstances.

(2) It is made illegal for milking-machine agents to install milking-machines in a manner not in conformity with the present regulations.

(3) It will be illegal, after 1st July, 1931, to sell for use in connection with milking-machines rubberware which is not branded with the manufacturer's name or brand.

(4) Milk and cream must be protected from the entry of birds, rodents, and other animals.

(5) In the North Island the three grades for cream are to apply all the year round.

(6) In the grading of full-cream factory cheese or standardized milk cheese, as from the 1st August, 1930, the following will be the maximum points for allotment: For flavour, 45; body, 20; closeness, 20; colour, 10; finish, 5.

(7) Butter for export must contain not less than 1.5 or more than 2 per cent. salt, except by arrangement with the Director of the Dairy Division to fill special orders.

Correction.—In the title "Varieties of Apples and Pears passed for Export, Season 1929," on page 144 of last month's *Journal*, the date should read "1930," as indicated by the context.

SEASONAL NOTES.

THE FARM.

Pasture Management.

THE pasture-management position is, at times, subject to rapid and radical changes between early spring and late spring. During that period there may be a change from the extreme of really hard and injurious grazing to the extreme of insufficiently close grazing. It is practically certain that the latter extreme occasions much the greater amount of pasture-injury and avoidable loss. From October onwards for several weeks on many farms the grazing is of a type which allows of a proportion of the vegetation reaching the flowering stage. Flower-head development is definitely undesirable. This is because it not only marks a falling-off in the digestibility of the nutriment in the herbage, but also means that the different nutriment substances are not present in such well-balanced proportions as characterize shorter and more leafy growth. Pasture-growth which is dominantly leafy is excellently suited to meet the requirements of wet stock, whereas pastures at the flowering stage are far from ideal sources of forage for such stock. Hence, in October it becomes necessary to prevent pastures becoming too long and mature in development.

The main means that may be employed to this end are (1) effective grazing management; (2) reserving for hay and ensilage all growth not needed to meet the current requirements of the stock; (3) distribution of droppings before they have been deposited long enough to bring about patches of rank, unrelished growth; (4) "topping" of pastures as an emergency measure when more than sufficient grassland has been kept under grazing, or when an area is characterized by much uneven growth due to earlier neglect in regard to harrowing.

Effective grazing management results most satisfactorily from a system of alternate heavy grazing and spelling of the fields. In working such a system it is necessary to concentrate the stock on to a few fields while the others are spelled. Essential features of the system may be stated as follows:—

(1) Even and relatively close grazing of a field under grazing before stock are transferred from it. If the farm stock consist principally of cows in milk, it will be necessary to transfer them from a paddock only when to keep them there any longer would bring about avoidable and undesirable falling-off in production. If a fairly substantial number of dry stock are on hand they well may follow the cows to remove inferior growth that is not readily consumed by the cows.

(2) Stock should be returned to a paddock which has been eaten down and spelled, not when all other paddocks available for grazing have been eaten down in turn, but when the growth on the spelled paddock is at the stage best suited for grazing. For instance, on a farm on which ten paddocks are being grazed, one paddock may be ready for grazing again when only six of the other nine paddocks have been grazed under this method. In such a case the three ungrazed paddocks should be dropped from the grazing programme and a return made by the stock to the paddock which has so recovered from previous grazing as to be at the best stage for grazing again. It is of vital importance to drop promptly from the grazing programme in this manner any fields which in the spring and early summer are providing feed in excess of the current requirements of the

stock. Some farmers carefully shift their stock from paddock to paddock at regular intervals. They profess to be practising systematic or rotational grazing, but actually they may be doing nothing of the sort; they do not always well graze down the growth on a paddock before taking the stock off it; they do not always return the stock to the paddock when the growth on it is at the best stage for use. As a result, they fail to obtain the benefits which effective grazing management gives.

Ensilage.

Farmers at times hesitate to drop a field out of the grazing programme because they have already planned the closing of sufficient other grass-land to meet requirements in the way of hay. When this is the case the paddocks not required for grazing may very advantageously be set aside for silage production. Although the amount of silage produced has increased enormously during recent years, there are hundreds of farmers who have not as yet made silage and who could do so with distinct advantage. At this time of the year it is well to remember that ensilage has a place in our farming not only as a source of reserve feed for use when fresh grass is in scant supply, but also as a valuable means towards proper control of pasture-growth. In late spring and early summer poor control of pasture-growth almost invariably arises from making available to stock feed in excess of their requirements at that season. Good control of growth at that period is of such value as to justify closing a field from grazing, even though the way in which the surplus growth on it would eventually be used cannot be clearly seen. Really it would be better to have such surplus growth wasted, if this led to the proper control of the growth on the remaining paddocks, rather than to have growth on all paddocks poorly controlled as a result of attempting to retain an unnecessary paddock under grazing.

At times it is of great value to top with the mower growth which tends to run to flower heads, even though the mown material is not gathered. Topping of pastures in this way is particularly likely to be of service in fields which have not been harrowed enough. Regular and thorough distribution of droppings by means of harrowing makes it much easier to maintain an even leafy growth over grassland during spring and early summer.

Under many conditions silage can very advantageously be made in October or November. Particularly in districts in which ensilage is a comparatively recent development a common error is the making of silage later than is desirable. The objection to late making of silage arises partly from the fact that increase of maturity means increase of fibre. Fibre in a feed does not favour milk production, and the amount of fibre in ensilage is largely determined by the amount of fibre in the green material from which it is made. Further, when ensilage is saved later than is necessary there is less certainty of a good aftermath on the field from which it was obtained. Again, when silage production is commenced in good time the summer labour requirements in respect to supplementary feed-provision are better distributed.

Fields to be closed for hay or ensilage production should be thoroughly harrowed immediately after the final grazing of the season.

Farmers who propose to utilize new pits or trenches for the saving of ensilage should proceed with their preparation without delay if this has not already been done. In many instances when pits cannot be obtained satisfactorily on account of the contour of the farms relatively shallow trenches will serve excellently. Detailed information on this matter will be supplied on application to officers of the Department of Agriculture.

The Potato Crop.

In many districts the main crop of potatoes should be sown in October. Potatoes fare best on a loose friable soil of high fertility, and if soil of this type is not available everything practicable should be done to produce it by using artificial fertilizers freely, and by growing the crop if possible on land recently ploughed out of old pasture, so that the supply of organic matter which begets friability may be at its maximum, or by applying to the potato-ground any available farmyard manure, provided it is not unduly infested with weed seeds. A fertilizer consisting of three to four parts of superphosphate and one part sulphate of ammonia, or two parts blood-and-bone, will give good results with potatoes over wide areas. In the manuring of potatoes there are more errors due to using too little than to using too much manure.

Great care should be taken to obtain seed which is free from disease infection. The most serious type of disease, which is known as virus, cannot be detected by tuber examination. The run-out condition of much seed offering is due to virus disease, of which there is no effective direct control. The Department of Agriculture undertakes the certification of seed potatoes. The main objective of this certification is to make available seed which is true to name, relatively free from disease, and of proved cropping-power. Each line of seed that is certified has been under official trial. In regard to varieties Mr. J. W. Hadfield, Agronomist, points out that difficulty arises because of the fact that of lines within a variety there are greater differences in yield under similar conditions than occur between one variety and another. This position is due principally to the ravages of virus disease masking differences in yield between varieties.

The following are well-proved varieties: Dakota, a standard main-crop variety that generally does particularly well on medium land in Canterbury; Aucklander Short-top (usually grown in the North Island as Sutton's Supreme), a second early which is a general favourite because it is relatively reliable; King Edward, a potato of outstanding quality, but one which does not yield satisfactorily except in Southland; Arran Chief, a main-crop variety which generally is badly mixed with Northern Star and running out on account of virus, but good lines of which should at present be the mainstay of heavier land; Northern Star, definitely blight-resistant, but not worth attention outside Auckland districts; Epicure, the only early variety which can be recommended, and this only in the case of certified seed.

Relatively soon the potato-variety position will be improved as the result of current official work. For instance, at Ashburton Experimental Farm 20 acres of pure lines, practically virus-free, of all standard varieties from England, Canada, and New Zealand are being sown this year, and seed will be on sale next April.

Other Cropping Work.

Chou moellier calls for high fertility—it demands a soil of the type which would suit cabbage. If it is desired to grow chou moellier on inferior soils their fertility should be improved, farm-yard manure being a fine dressing for this purpose. If sown in October or November on fertile soils chou moellier is well adapted to provide feed in late summer. A suitable sowing is 1½ lb. to 2 lb. of seed to the acre broadcast, or ½ lb. to ¾ lb. in drills 2 ft. to 3 ft. apart. The plant responds well to liberal use of fertilizers, such as a mixture of super and blood-and-bone in equal parts; 3 to 4 cwt. of this mixture may usually be applied with profit, and such a dressing may often advantageously be supplemented with 1 cwt. of sulphate of ammonia. Chou moellier is less subject to attacks of disease than other members of the cabbage family. It is distinctly suitable for cows, pigs, and poultry. Quite a number of successful sheep-farmers favour it for carrying sheep through the winter. It will not fatten lambs as well as rape.

Preparation of land intended for roots, rape, and kale should be pushed ahead at every opportunity. It is well to remember that often inadequate preparatory cultivation results in depressed yields of forage crops. In the earlier districts sowing of turnips may be commenced in October. When it is desired to have soft turnips ready for feeding as early as possible, a sowing of the quick-maturing Lincoln Red and Red Paragon varieties may be made for a start. Other varieties of proven merit are Hardy and Imperial Green Globe and Purple-top Mammoth. Soft turnips may be sown through every second coulter of the grain drill at the rate of 8 oz. of seed to the acre, or on ridges 24 in. to 26 in. apart at the rate of 1 lb.

An October sowing of Western Wolths or Italian rye-grass will often give useful feed about Christmas or immediately afterwards.

Lucerne.

If lucerne areas have not as yet been shut up this should be done immediately. Many stands suffer serious damage because the first cut for ensilage or hay is taken off too late in the season. The more the lucerne area is invaded by weeds the greater is the need to remove the first cut of the season as early as is practicable, for the longer the weeds remain uncut the more prolonged is their injurious effect on the lucerne plants, with which they compete for light and nutriment.

True and False Economy regarding Equipment.

Reference may fittingly be made at this season to the confusion between false and true economy that at times occurs in respect to the equipping of farms with implements and other plant. It is not necessarily true economy to continue using equipment merely because it is far from worn out and therefore appears to have definite value. When it is a matter of considering whether a piece of equipment should be scrapped the true test is not whether it is capable of rendering further service, but whether it can or cannot be replaced by some other equipment which would so effect the efficiency of the farm as to enable the money involved to earn a higher rate of interest.

To give an instance, many farmers are doubtful about the advisability of purchasing modern grass-harvesting equipment, because the carts, &c., which have served for years have still many years of life in them. This latter fact does not at all justify the retention of such equipment in use. Indeed, it is quite conceivable that its retention, instead of being true economy, would be the cause of loss of potentially valuable returns which would result from the improved grassland management coming from such a practice as ensilage-saving that improved equipment would make possible. Similar lines of reasoning may soundly be applied to many other types of farm equipment, such as harrows, drainage implements, and possibly tractors.

It is important to remember that success in farming depends in many matters on getting the work done at the right time. Certain equipment may enable a job to be done well, but not at the right time or not without neglecting some other job. Such equipment is not to be compared in value with that which allows of all work being done at the right time. The aim in this note is not to go into a detailed consideration of the position, because each farm presents its own problems, but to point to the importance of differentiating in practice between true and false economy in regard to equipment.

Seasonable Care of Implements.

All implements and equipment that will be in use during the saving of hay and ensilage should be made ready for immediate use, well

ahead of the time when they are likely to be put to use. Time lost through faulty equipment, especially in connection with the saving of hay, at times proves very expensive. A point of seasonable importance is the fact that the foundation of successful mowing is a sharp knife. Time and again mowing troubles due to clogging and stopping will disappear as a result of using a thoroughly sharp knife. The knife forms with the bed of the finger-bar a pair of long scissors, and to work efficiently it must be sharp, straight, and, above all, well down on the bed. In addition to the knife being really sharp it is necessary that the fingers be in line and their points kept straight, sharp, and smooth. Bent or blunt finger-points will stop the mower just as effectually as dead grass.

—R. P. Connell, M.A., *Fields Division, Palmerston North.*

THE ORCHARD.

Spraying Operations.

WHAT may be termed the active season in the orchard commences with the month of September. Bud-shields will be shed, while foliage and blossom will become exposed to the attacks of insect pests and infection with fungus diseases. In consequence, spray controls will become imperative, commencing on stone-fruits at bud-movement, and on pome-fruits at green-tip.

The standard formulas recommended at different stages are as follows :—

Stone-fruits.

For control of bladder-plum, brown-rot, die-back, leaf-curl, leaf-rust, peach scab, and shot-hole fungus—

Bud-movement: Bordeaux 5-4-50, or lime-sulphur 1-15.

Early Pink: In those districts in which brown-rot is prevalent additional applications of a lime-sulphur solution, consisting of either lime-sulphur 1-120 or self-boiled lime-sulphur 8-8-50, or precipitated sulphur 8-100, are essential.

Later periods: The lime-sulphur or sulphur sprays should be repeated one month after petal-fall, again three weeks later, and again shortly before the different varieties ripen. Self-boiled lime-sulphur is specially recommended; an application of this spray an hour before picking stone-fruit will be beneficial in preventing brown-rot developing after the fruit is placed on the market.

Pome-fruits.

For control of black-spot, pear scab, fabraea scald, apple-spot, and blister disease—

Green-tip: Bordeaux 5-4-50, or lime-sulphur 1-10.

For varieties of pears most susceptible to pear scab, bordeaux 6-5-50 can be recommended, followed by bordeaux 4-4-50 at pink and 3-4-50 at the calyx stage. A word of warning may be given here with regard to the application of bordeaux at what is regarded as the green-tip stage. It would appear that last season some of the excessive russet experienced in certain districts was due to bordeaux 6-5-40 and 6-5-50 being applied at a stage when the trees had advanced beyond what is correctly regarded as green-tip.

Open Cluster to Pink: Lime-sulphur 1-30 to 1-50, according to variety; or bordeaux 3-4-50, according to variety.

For varieties of apples which are supersensitive to burning of foliage or russetting of the skin, less risk is entailed by confining the spraying

to lime-sulphur. If necessary the lime-sulphur content may be supplemented by adding precipitated sulphur in quantities ranging from 5 lb. to 10 lb. per 100 gallons.

Petal-fall: Lime-sulphur 1-100 to 1-120, to be repeated ten days later, or as frequently as climatic conditions or the prevalence of disease makes application necessary. This spray should be continued until the period for harvesting the different varieties arrives.

Apples required for storage should receive an additional application of lime-sulphur 1-100 shortly before picking. In this connection growers who can find opportunity to apply an oil spray of 1 150 immediately prior to picking those varieties subject to scald in cool storage may do valuable work for themselves.

Insect Pests.

For codlin moth, pear-slug, leaf-roller caterpillar, &c., arsenate of lead, 3 lb. of paste or 1½ lb. of powder to 100 gallons water, should be applied at calyx stage, and at not more than three-weekly intervals thereafter.

For control of red mite and San Jose scale at the young stage, red-oil emulsion at 1-150 should be applied immediately the young insects are noticed. Lime-sulphur 1-120, plus Black Leaf 40 at 1-800 may be used as an alternative.

A limited control of woolly aphis and bronze beetle may be expected if Black Leaf 40 is added to the red-oil emulsion. Where the activity of *Aphelinus mali* is delayed orchardists would be well advised to apply this spray to control woolly aphis.

It should be borne in mind that clean cultivation is one of the chief factors controlling bronze beetle.

Supplementary Manuring.

In addition to the main application of manure which will have been made, a special application of stimulating fertilizers such as nitrate of soda or sulphate of ammonia is good practice where trees are debilitated or stunted. A top-dressing of 1 lb. per tree of either of these manures will do much to stimulate good growth, improve the size of the fruit, and otherwise bring weak specimens into line with the more vigorous trees in the orchard.

Grafting.

The period for carrying out this work will be about the middle of the month in most districts. Care of scions, close-fitting of all unions, and careful sealing up of all cut surfaces are the essentials to success. This work was the subject of an illustrated article in the *Journal* for September, 1929.

—M. Davey, Orchard Instructor, Mapua.

Citrus-culture.

Planting should have been done before now. However, where this has been delayed no time should be lost in completing the work. If this is unduly delayed it may be detrimental to the young trees should the weather be dry. One is often confronted with the fact that sufficient care has not been exercised beforehand in the preparation of the soil. If this has not been done it would be much more satisfactory to defer the planting for another season.

It is possible that a good deal of damage has been done by the recent frosts. Where this has occurred it will be necessary to cut back all affected wood to a point at least below where no injury has taken place. This should not be done, however, until the danger of frost is past. In all pruning the aim should be to produce short sturdy shoots capable of bringing to maturity all fruit produced on them.

If the soil is in a suitable condition the land may be turned over with the plough, but this should not be done if the soil is in a wet or sodden

condition. All care should be exercised in ploughing operations in order to minimize damage to either roots or branches; all damage so caused is detrimental to the trees.

Manuring at this period of the year should not be lost sight of. Any neglect in this direction is very soon reflected in the appearance of the trees. Citrus-trees are gross feeders, and require to be carefully watched so as to find out what they require. Three manures—phosphates, nitrogen, and potash—are essential to almost every tree, and should be applied in an intelligent manner. If trees are making strong healthy wood-growth, nitrogen could be reduced or eliminated, while phosphates or potash may be still necessary. The amount required can only be determined by the person growing the trees, and varies in different localities. In practically every district all trees would greatly benefit by the application of fertilizers at least twice during the year, instead of once as is commonly practised. Citrus-trees respond in a wonderful way to almost any form of mulching, but this operation is practically impossible.

Growers should be making some preparation for the spraying of citrus for the control of verrucosis and scale insects, which make their appearance soon after the main blossoming is finished. This will be dealt with next month, but it is well for growers to realize that the danger period is approaching, and to be in readiness to carry out the work when the time arrives. The control of all diseases is really only a matter of facing the work from a business point of view. Much of the failure is due to half-hearted methods and lack of foresight. Therefore it is wise to be well prepared to carry out each phase of the work at the correct time.

—L. Paynter, Orchard Instructor, Auckland.

POULTRY-KEEPING.

Rearing of Ducks.

THERE is still time to hatch out ducklings for the renewal of the laying flock, but an endeavour should be made to have the required number not later than the early part of November. In anticipation of early hatching the breeding-stock should be mated at once. Ducks, particularly the heavier breeds, usually have to be mated much longer than fowls to ensure the production of a maximum number of fertile eggs.

In mating Indian Runners one drake is usually allowed to six females, and for the heavier breeds one drake to four ducks. This refers to birds which are confined in runs, for on free range the number of ducks to one drake may be considerably increased. When the drakes commence fighting it is an indication that more ducks are required in the breeding-pen, or that the number of drakes should be lessened.

Ducks are easy to hatch and rear by artificial means. The temperature during the period of incubation at the level of the tops of the eggs on the tray should be 102° F. for the first week, from then on to the pipping stage 103°, and 104° when hatching. Given this degree of heat, and provided the eggs are fairly fresh when set, the ducklings will commence to pip on the twenty-sixth day, and hatch out on the twenty-eighth. Many people become alarmed at the hatch being delayed for this length of time after the pipping stage, and attempt to assist the ducklings out of the shell. This is a great mistake, for by opening the machine and interfering with the eggs in any way before allowing them their full time of hatching one is only inviting trouble.

Apart from the application of moisture, duck eggs require much the same treatment during the various stages of the incubation as do hen eggs.

The best system of applying moisture, which is one of the chief secrets in hatching duck eggs, is to spray water at a temperature of 103° with a fine florist's spray, or, better still, with the mouth, on the eggs every morning after the fourteenth day. Do this after turning, and immediately place the eggs back in the machine. It is a mistake to cool after spraying; spray in the morning and cool at night. The ventilation vents should be partly open at all times, so that any excess of moisture not required by the eggs can get away.

Ducklings require no food for at least twenty-four hours after they are hatched. For the first few days feed equal parts of bran and pollard mixed with a small quantity of oatmeal, with 5 per cent. of sharp fine grit added; moisten with hot water and mix to a crumbly consistency. Feed four times a day as much as the birds will pick up clean. Finely cut green food, such as young tender grass, lettuce, silver-beet, &c., should be fed daily after the first week. As the birds develop the oatmeal may be dispensed with, while ground wheat, barley, or oats with the husks screened out, and also maize-meal, may be included in the mash. After the ducklings are a week old the grit should not be mixed with the food, but should be kept within reach so that they can help themselves. At this stage finely broken sea-shell should also be available to them at all times to pick at. When a week old a little boiled minced meat will be much relished by the young birds, and water should be given with the first meal, and from then onwards it should always be left within reach both day and night.

It is of the greatest importance that the birds should not be given water after a long fast until they have received a meal, and even then it is a wise course to provide water with the chill taken off; further, it is well not to let them drink to excess at the outset. When ducklings are given a cold drink before food, especially if they have been confined in a brooder without water, they are almost sure to suffer from staggers, with fatal results. Ducklings thus affected give every indication of having taken a fit, falling on their backs, with eyes twitching and presenting a generally distressed appearance.

Care should be taken to arrange the brooder so that the young birds are provided with the desired uniform degree of warmth and an ample supply of fresh air, two great essentials when artificially rearing ducklings.

Although ducks are water-fowl, it is imperative that the sleeping-quarters of domestic ducks, whether old or young, be maintained in the driest possible condition, or leg-weakness is almost sure to result. During the early brooder stage the drinking-vessels should be arranged so that the ducklings can merely get their heads into the water when drinking. This will to a great extent prevent the bedding-material from getting wet. After a period of from three to four days the water-vessels should be placed in the brooder run well away from the sleeping-quarters, so as to save as much as possible the latter from getting into a wet state. At this stage the water-vessels should be of sufficient depth to allow the birds to clean out their nostrils, and so prevent them from getting clogged up, which is a common cause of the eyes becoming plastered, and failure of the ducklings to thrive. Some fine gravel placed in the drinking-vessels will generally assist in moving any food or dirt from the nostrils.

On account of the thinness of their skulls ducklings are very subject to sunstroke followed by giddiness, and therefore shade should be available to them when let out of doors. Care should be taken to see that they are well protected from their natural enemies, such as rats, stoats, and ferrets, which will attack them until they are fully three-parts grown.

On no account should ducklings be overcrowded by hatching out more than the quarters can properly accommodate. Work only with numbers that can be handled with absolute confidence. An even degree of warmth, good ventilation, and strict attention to cleanliness are among the chief factors in rearing brooder ducklings.

Provision of Green Food.

As the season advances and warm weather may be expected there should be no stint of green food on the poultry-plant. The growing birds particularly demand an adequate supply of green material. Evidence of this is frequently to be seen during hot weather when chickens practically refuse to eat grain material unless forced to by hunger, whereas if green stuff is thrown to them they will simply rush it. Obviously what they require is what they eat up greedily, and what they need for promoting healthy development—an essential requirement for future heavy egg-production. For growing stock, also, the green stuff provided should not be old and fibrous, otherwise crop and gizzard impaction are apt to result, which usually causes death.

A thing to be remembered in feeding an ample supply of green material to birds of all ages is that it not only keeps the birds in a healthy thriving state, but in addition it goes a long way towards saving the present high-priced grain materials.

Experimental Work at Wallaceville.

Although considerable knowledge is available regarding the many phases connected with the management of poultry, troubles are frequently met with under varied local conditions on which even the most practical poultrymen are unable to give definite advice as to their cause and the best means of prevention. Among these troubles may be mentioned fully developed chicks dying in the shell in incubators at the pipping stage, non-absorption of the yolk in artificially produced chicks, cannibal habits, bowel trouble, green leg, passing blood in droppings, and various conditions met with in the work of artificial brooding. There is also much to be learnt yet in regard to the control of external and internal parasitic infestation, particularly the latter, and many other problems met with in connection with the feeding, housing, and general management of poultry stock.

Experimental work to discover if possible the causes and necessary preventive measures in connection with some of these problems is being conducted at the Wallaceville Poultry Station. Investigational work is also being carried out in feeding iodine to fowls, chiefly for the purpose of ascertaining its effect on egg-production and the hatching-quality of eggs. These experiments are being carried out in co-operation with the officer in charge of the Veterinary Laboratory.

—F. C. Brown, Chief Poultry Instructor, Wellington.

THE APIARY.

Seasonal Preparations.

OCTOBER is perhaps the period when the apiarist can do most in helping his bees to work up to full strength in time for the main honey-flow. In the warmer parts of the country swarms may be looked for about the middle of the month, but in the southern districts they will probably not appear until three or four weeks later. By the 1st October, unless the weather for some weeks has been cold and wet, every hive should have been examined, and its condition noted with regard to stores, population, and health.

No colony should be allowed to dwindle because it has not sufficient food to provide for the offspring of a prolific queen. Yet, on the other hand, some beekeepers prefer that all the old honey in the hive should be used up before the new season's flow commences. The food-supply of the

hive is sometimes an exceedingly puzzling matter, as it varies considerably in accordance with the weather and the strength of the colony, and only periodical and systematic examinations can settle the question as to whether all is well with the hives in this respect.

No harm can be done by feeding good white sugar syrup, but a hive which is starved in the spring will probably not recover its strength till the main honey-flow is nearly over. By the middle of October, under normal weather conditions, every hive should have at least four frames of sealed brood, and many will have more. Those that have fewer, unless their food-supply is very short, should be marked for requeening as soon as possible. The apiarist's endeavour should be to keep his colonies as even as possible, thereby obtaining a uniform surplus throughout the apiary.

Wherever there is a fair yield of nectar from spring flowers the beekeeper would do well to take advantage of the warm days of the month to treat any cases of foul-brood which he may have noted earlier in the spring. However, no hard-and-fast rule can be laid down in this matter, everything depending on locality and weather conditions. In some districts it would be almost disastrous for the beekeeper to treat his bees in October; in others, where right conditions prevail, it might be carried out with ease and safety, and the bees brought into good condition by the time a surplus may be expected. Wherever treatment has been undertaken the colonies should be watched in order to see that there is no danger of starvation, and where the spring flow is not considered heavy enough it should be supplemented by liberal feeding.

Hiving Swarms.

In most text-books on beekeeping this kind of advice is given: "When a swarm settles into a cluster take a light box and shake the bees into it," &c. This advice is all right where the bees are accommodating enough to settle into a convenient position for the shaking process to be carried out. Unfortunately, in many cases bees get into positions whence it is impossible to dislodge them so easily. Sometimes they will settle on a small bush, and much of the cluster will be on the ground. In this case probably the best thing to do is to place the box over the cluster, and if the bees do not show much disposition to climb into the box they may be persuaded to do so by the use of a little smoke. When they cluster in the centre of a prickly hedge the box should be placed on one side of the hedge, and the beekeeper should puff smoke from the other side of the hedge, and thereby drive the bees towards the box. In the event of the swarm taking possession of a fencing-post and clustering on it from top to bottom, as they occasionally do, the smoker must again be used, and in addition it is as well to brush the bees from each side of the post in turn into the swarm-box with the brush which is used for the frames at extracting-time.

The usual practice is to leave the box sheltered from the sun and covered with a sack near the place where the swarm has settled. Where few hives are kept this may be done with impunity, but if other swarms are expected it is well to remove the box to the place where the colony is to stand permanently, otherwise before the close of the day the probabilities are very largely in favour of the box being taken possession of by three or four other swarms—a matter of annoyance to the man who wishes to keep his swarms separate.

In every case a swarm should be attended to as soon as it settles. Many people are under the impression that swarms should be left undisturbed till nightfall, but this idea is an erroneous one. They should invariably be placed in the box as soon as possible after the cluster is formed, and put so that they are sheltered from the rays of the sun.

Water Supply.

One of the most important of the minor details of apiculture is the provision of a constant water supply for the purpose of assisting the bees in brood-rearing. Not only is it necessary to conserve the energy of the bees by having the water close at hand, but it is well to ensure that they do not prove a nuisance at taps, cattle-troughs, &c. From early spring till late autumn water is an absolute necessity to bees, and they will consume comparatively immense quantities in fine weather. It thus behoves the beekeeper to see that a liberal supply is always available. By establishing his drinking fountain early in the season he will teach the bees where to go for supplies, and ensure their always seeking the same spot for water.

—E. A. Earp, *Senior Apiary Instructor, Wellington.*

HORTICULTURE.

Small Fruits.

IN the next few weeks most plantations of small fruits will be approaching the harvest period, and little attention generally will be required apart from hoeing in bright weather to destroy weeds. Superfluous suckers in the raspberry crops should be suppressed, or, if it is a desirable variety and more plants are required, they may be lifted and planted out in nursery rows to be grown on.

Strawberries will require bedding down with straw, rushes, or pine-needles. It is very rare that this attention can be dispensed with; it forms a cooling mulch, keeps the berries free from grit splashed by the rain, and prevents the growth of weeds, so long as it contains no viable weed-seeds itself. For this reason when baled straw is used it is exposed to the open air for some time before using, so that all seeds may be sprouted and destroyed before applying it. Where new plants from runners are desired the mulch should not be applied nor the plants allowed to fruit. They then concentrate on runner production, and good early plants may be obtained. This production should be controlled, the plants will be all the better if only the first on a runner is allowed to develop.

Indoor and Outside Tomato Crops.

Warmer weather sets in during October, and the foliage of the tomato crop under glass is then of such a bulk that very little room is left for the circulating air. As this plant demands a dry buoyant atmosphere, it is not surprising that many growers find a difficulty here. The crops fail to set satisfactorily and mould develops. These are some of the troubles due to excessive temperatures and a humid atmosphere. They are found in houses with insufficient ventilation or where ventilation is not given sufficient attention. For this crop generous facility for ventilation along the ridge of the roof is required, and especially is it the case in the warmer latitudes and localities. In such places ventilators in the side walls also would doubtless be of benefit. The water vapour constantly given off on a warm day by large plants planted so closely is very great, and unless it is driven out through the ventilators the atmosphere becomes saturated and the constitution of the plants is affected. Furthermore, where the facilities are available they are, of course, useless unless they are used promptly and intelligently. To allow a house to become overheated and then throw it open to a cold draught is unsatisfactory, and equally distressing to the plants. One who has charge of such glasshouses should be an early riser at this season and make the matter of ventilation his first

consideration. Very soon after sunrise in fine weather ventilation should be given generously before the temperatures rise unduly; the plants are then kept in a hardy vigorous state.

Another important feature is the matter of cultivation. The preparation of the land for planting can hardly be too thorough, but, once the plants are set out and established, hoeing should be done merely to destroy weeds and break up the surface crust if it develops. To cultivate deeply and injure the tender fibrous roots which are so near the surface is to seriously check the plants, and this accounts for many of the thin debilitated crops which are so frequently seen.

Tomato-plants for outside cropping should now be carefully hardened off in cradles where they can be covered when necessary. They will generally be benefited by an application of bordeaux spray while still in the boxes. In the warmer localities they may be planted out towards the end of October. They should be planted deeply and firmly in land that has been well prepared and allowed to consolidate. Inspect each plant carefully, and reject those that are undersized or abnormal in any way. A good crop cannot be obtained from poor plants, and a moderate area of good plants is more profitable than a larger area of plants that are uneven.

The Market Garden.

The quality and variety of vegetables displayed for sale in the larger towns during the past winter have been very creditable to the growers. The celery, cauliflower, broccoli, savoys, and brussels sprouts especially have been of nice handy size and excellent condition. The movement now on foot to grade the produce and standardize the packages will go a long way towards putting the trade on a better business footing. There then remains the bigger problem of making an even distribution and regular supply in season, so the consumer may form the desirable habit of making more use of these valuable foods. The method of cooking vegetables and serving salads here often leaves much to be desired, and the writers of household notes in papers and magazines would probably require but little encouragement to make a feature of these subjects if growers' organizations would supply them with seasonable information.

The main sowings in the coming month will be the more tender crops, such as marrows, pumpkins, cucumbers, melons, and runner and dwarf beans. Seeds of the important winter crops should also be sown in well-prepared beds for planting out early in the New Year. They include celery, leeks, cauliflower, broccoli, and savoy cabbage. Expensive seed is not always good, but cheap seed cannot be. For commercial cropping no trouble is too great to see that the best seed-strains are obtained.

The Home Garden.

"The appearance and comfort of the home garden depend to a great extent on smooth lawns and clean walks. These will require some attention now to keep them in that condition. A good liquid weed-killer, applied with a watering-can with a rose sprinkler attached, is the easiest way of dealing with weeds on walks and drives. If the metal is then raked into position and rolled after a heavy rain it will maintain its shape.

The lawns will require cutting weekly now for awhile. This should be done when the grass is dry, using a mower that is clean, well oiled, and with the cutting cylinder set rather close on the bed-plate. On medium to heavy land moderate use of the roller when the ground is moist will improve the surface of the lawn. On light land more attention of this kind might be given with advantage.

—W. C. Hyde, *Horticulturist*, Wellington.

GRADING OF EXPORT BUTTER AND CHEESE.

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1929-30.

Dairy Division.

Lists of butter and cheese factory companies or proprietaries which have obtained for their export produce an average grade of 93 points or over for the past dairy year—1st August, 1929, to 31st July, 1930—are here presented. Ninety-three butter-factories and nineteen cheese-factories have gained a place in the lists this year, compared with seventy-five and thirty respectively for 1928-29. It will be noticed that thirty butter-making concerns have gained the highly creditable average of 94 points or over, the highest average grade being 95.245. Only one cheese company, with an average grade of 94.018, reached this level. Of the concerns which have gained a place in the list, seventy-five butter-making and five cheese-making are located in the North Island, and eighteen and fourteen respectively in the South Island.

Company or Proprietor.	Registered No.	Brand.	Average Grade Points.
Butter-factories.			
Rangitikei	1360	Rangitikei ..	95.245
Wangaehu	1326	Wangaehu ..	95.187
Taieri and Peninsula (Dunedin) ..	54	Taieri and Peninsula ..	95.128
Rata	938	Rata	95.123
Golden Bay	146	Sovereign	95.060
Shannon	1489	Shannon	94.047
Awahuri	664	Red Rose	94.890
Levin	910	Lake	94.833
Rangivahia	750	Quail	94.765
Rongotea	8	Rongotea	94.591
Lepperton	49	Lepperton	94.563
Arahura	1516	Arahura	94.552
United	1220	Whariti	94.453
Waitaki	812	Waitaki	94.438
Taieri and Peninsula (Oamaru) ..	1234	Taieri and Peninsula ..	94.388
Palm	1838	Palmerston	94.362
Moa Farmers'	341	Inglewood	94.320
Kokatahi	1144	Kokatahi	94.303
Farmers' Dairy Federation (Invercargill) ..	336	Murihiku	94.300
Midhurst	110	Rugby	94.292
Torurutangi	728	Champion	94.235
Wellington Municipal Milk	202	Rahui	94.217
Tarata	631	Tarata	94.159
Kia Ora	926	Kia Ora	94.153
Mangorei	345	Mangorei	94.094
Whakaronga	1709	Whakaronga	94.087
Taihape	1188	Tikapu	94.062
Tikorangi	102	Shield	94.058
Kaikoura	302	Kaikoura	94.004
Maketawa	342	M.D.C.	93.994
Kuku	905	Ohau	93.983
Apiti	414	Apiti	93.967
Cheltenham	3	Pakeha	93.957
Raetihi	717	Raetihi	93.940
Tolaga Bay	1007	Tolaga Bay	93.900
Waitara	726	Waitara	93.881
Wairoa	1345	Wairoa	93.855

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1929-30—*continued.*

Company or Proprietor.	Registered No.	Brand.	Average Grade Points.
Butter-factories—<i>continued.</i>			
Murchison	1888	Airship	93·844
Pembroke Road	234	Pembroke	93·839
Tariki	1818	Tariki	93·822
Golden Coast	387	Golden Dawn	93·810
Konini	1203	Konini	93·808
Norsewood	600	Norsewood	93·794
Inter-Wanganui	6	Inter-Wanganui	93·793
New Zealand (Ngatea)	291	Anchor, &c.	93·780
Okau	872	Okau	93·776
Lowgarth	629	Lowgarth	93·769
Golden Coast	991	Golden Coast	93·757
Omata	82	Omata	93·701
Kaponga	732	Kaponga	93·646
Kairanga	1768	Longburn	93·636
Uruti	300	Uruti	93·555
Co-operative of Otago	266	Huia	93·509
West Coast Farmers'	675	Silver Pine	93·491
Mangatoki	136	Mangatoki	93·469
Karamea	1570	Karamea	93·428
Heretaunga	1230	Heretaunga, &c.	93·416
Opotiki	337	Opotiki	93·391
Kati Kati	1305	Kati Kati	93·374
Heretaunga (Waipukurau)	1455	Mount Vernon	93·354
Kaitaia	1298	Kaitaia, &c.	93·343
Waitoitoi	20	Waitoitoi	93·341
Ngatiporou	395	Nati	93·325
Te Aroha	345	Overseas, &c.	93·300
Cambridge	1239	Cambridge, &c.	93·298
Hokianga	1843	Hokianga, &c.	93·289
Mokau	274	Mokau	93·285
Otaki	1236	Kapiti	93·264
Rangitaiki Plains	133	Rangitaiki Plains, &c.	93·278
Pio Pio	603	Pio Pio	93·265
North Taranaki	723	Flax	93·258
Waipu	1248	Waipu	93·237
Bell Block	488	Bell Block	93·217
Mauriceville	14	Mauriceville	93·211
Caroline	236	Caroline	93·195
Royal Oak	693	Royal Oak	93·184
Kaitieke	1119	Kaitieke, &c.	93·182
Masterton	1307	Masterton	93·169
Kaipara	794	Poplar, &c.	93·161
New Zealand (Waiuku)	111	Anchor, &c.	93·154
Ofuru-Fairburn	1337	Fairy	93·150
New Zealand (Otorohanga)	185	Anchor, &c.	93·128
East Tamaki	301	East Tamaki	93·121
Eltham	31	Eltham	93·095
Cape Egmont	632	Cape Egmont	93·094
Farmers' Dairy Federation (Gore)	165	Gore	93·085
New Zealand Farmers' Dairy Union	100	Hinemoa	93·083
Raglan	1470	Raglan	93·075
Springhead	180	Springhead	93·075
Alpine	792	Pine	93·050
New Zealand (Waharoa)	293	Anchor, &c.	93·041
Maungaturoto	1407	Otamatea	93·017
Whangarei	1720	Kauri, &c.	93·008

LEADING DAIRY-FACTORY AVERAGES FOR YEAR 1929-30—continued.

Company or Proprietor.	Registered No.	Brand.	Average Grade Points.
Cheese-factories.			
Tamaki	58	Tamaki	94.018
Kaiparoro	619	Bruce	93.991
Omimi	74	Omimi	93.573
Stirling	292	Stirling	93.543
Waianiwa	1171	Waianiwa	93.538
Ryal Bush	477	Ryal Bush	93.531
Dalefield	9	Dalefield	93.526
Milton	1030	Milton	93.524
Barry's Bay	401	Onawe	93.512
Edendale	36	Pioneer	93.373
Mabel	29	Mabel	93.325
Rapaui	714	Southern Grove	93.246
Morton Mains	1604	Morton Mains	93.220
Kairanga	1768	Fitzherbert	93.206
Tokonui	656	Tokonui	93.190
Pine Bush	543	Pine Bush	93.050
Merton	45	Merton	93.043
Momona	1010	Momona	93.041
Awarua	545	Awarua	93.040

INVENTIONS OF AGRICULTURAL INTEREST.

APPLICATIONS for patents, published with abridged specifications in the *New Zealand Patent Office Journal* from 17th July to 11th September, 1930, include the following of agricultural interest:—

No. 62896: Gorse-cutter for tractor; J. W. Belgrove, Kirwee. No. 63322: Treatment of flax; W. J. Butler, Ruatapu. No. 63332: Sheep-shearing-machine drive; F. C. McNamara, Auckland. No. 63353: Harrow; A. C. Sutherland, Whakatane. No. 62358: Carcass for market; Swift and Co., Chicago, U.S.A. No. 63008: Controlling growth of horns of cattle; E. C. McDermott, Hastings. No. 63046: Harrow; A. C. Sutherland, Whakatane. No. 63062: Manure-distributor; A. W. Stuckey, Morrinsville. No. 63509: Brooder; W. I. Hunter, Patumahoe. No. 63859: Cleaning pipes of milking-machine; R. G. Carrie, Te Rapa. No. 64125: Lifting and stacking hay; H. G. Wine and J. F. Batley, Tirau. No. 65147: Labelling cheese; W. C. Bagrie, Seaward Downs. No. 63321: Removing manuka and gorse; J. Teschemaker-Shute, Mangatahi. H. B. Tennent, Hawke's Bay, and E. Fraser, Hastings. No. 64320: Manure-distributor; Hill Top Dressers, Ltd., Masterton. No. 63239: Concrete fencing-post; P. J. Marfell, Waipukurau. No. 63467: Shearing-machine comb-plate; J. Davidson, Sydney, N.S.W. No. 64997: Milking-machine releaser; R. F. Mehrtens, Te Aroha. No. 63098: Wool-baling press; R. B. D. Walker, Blenheim. No. 65153: Scarecrow; W. Griffiths, Auckland. No. 63558: Chain harrow; Booth, MacDonald, and Co., Ltd., Christchurch. No. 63614: Foot-rot treatment; G. V. Fry, Homewood, Vic. No. 63681: Administering animal drench; L. M. Jones, Manutuke. No. 64235: Milking-machine; W. R. Cockburn, Awhitu. No. 64950: Milk or cream cooler; J. Paterson, Invercargill. No. 65057: Manure-distributor; J. W. Yarnall, Wellington. No. 65393: Egg-handling machine; W. Hilgers, Düsseldorf, Germany.

Copies of full specifications and drawings in respect of any of the above may be obtained from the Commissioner of Patents, Wellington, price 1s. prepaid.

REVIEW.

Perennial Rye-grass at Aberystwyth, by T. J. Jenkin, M.Sc., Welsh Plant Breeding Station, Aberystwyth, in the *Welsh Journal of Agriculture*, Vol. VI, 1930, pp. 140-165.

THE author deals with specific investigations conducted at the Welsh Plant Breeding Station, Aberystwyth, on perennial rye-grass samples drawn from all over the world. The earlier publications of 1919-21 are reviewed, and it is pointed out that the distinction between British indigenous rye-grass and commercial rye-grass from other sources is still retained—the former have proved to be better suited than the latter to British pasture conditions. The present report deals with the rye-grass investigation over the ten-year period 1919-29.

The author emphasizes the essential need for single (spaced) plant studies in regard to pedigree-strain building in rye-grass, an important implication wholly confirmed by the New Zealand work of Levy and Davies. Tables given in the paper show that under Aberystwyth conditions Hawke's Bay rye-grass is outyielded only by pedigree Aberystwyth-bred lots.

Of further interest to New Zealand are the author's comments on this country's rye-grass as a whole. The following are extracts from the paper: "New Zealand rye-grass at its best may at once be stated to be very good; at its worst it is very bad. In fact, two rather distinctive sub-groups must here be recognized. . . . In the first sub-group must be placed Hawke's Bay, Poverty Bay, and to some extent Sandon. These may be referred to as Class A. In the second group has been placed [seed from] Sandon, Canterbury, and Southland districts, together with a few lots of unknown origin. These may be referred to as Class B. . . . The fact that these two extreme classes exists under the name "New Zealand" is of grave importance both to the British agriculturist and to the export trade of the Dominion. . . . Poverty Bay [and Hawke's Bay] seed already commands a higher price than Southern on the New Zealand market. It therefore follows that when seed is available for export to this country [Britain] it will very largely be of the inferior "Class B" type . . . and will probably find a ready sale—to the detriment of British agriculture and eventually of the Dominion's export trade. . . . The British farmer can with every confidence be urged to use Class A New Zealand seed, and with equal confidence to reject Class B New Zealand seed. If . . . one might presume to offer advice to the Dominion in the matter of exporting seed to this country it would be, 'Do not export any of the Class B type; export only seed from such area as produce Class A type, and see that in these areas the poor types are rigidly excluded' . . ."

The author then discusses the origin of what he terms Class A and Class B rye-grass, and concludes that Class A (the true perennials of Levy and Davies) is representative of the best types in British commercial seed, and by so much is superior to British commercial. This is not in complete agreement with the New Zealand work, where British commercial lots under test have shown quite close affinities with some of the false perennials (Class B).

The suggestions made relative to the origin of Class B rye-grass (the false perennial of the New Zealand workers) are interesting, and most probably accurate. It is concluded that Class B lots are derivatives, firstly, of selection of the most lax types in British commercial, and, secondly, by the intercrossing of these with Italian rye-grass. Similar conclusions have been arrived at by Levy and Davies in New Zealand.

The discussion dealing with Australian "Wimmera" rye-grass is only of secondary interest to New Zealand. The author shows that Wimmera rye-grass as found in commerce shows very close affinity with Class B, or the false perennial of New Zealand.

Comparing the Aberystwyth work under review and the similar studies now being conducted at the Plant Research Station at Palmerston North, there is found quite close agreement. The Aberystwyth work has the advantage of intensive study over a ten-year period, whereas the Palmerston

North work is considerably younger. The work emphasizes what is already apparent at the New Zealand end—that we have little to gain by wholesale importations of commercial rye-grass seed from overseas countries. The domestic rye-grass-strain position can be most rapidly improved and to some degree righted by the careful earmarking of our best true perennials of "Type 1", as defined by Levy and Davies, followed by an extensive and well-controlled scheme of "once growing" our best types. The report as a whole is on eminently sound lines.

In the fostering and the development of New Zealand as an Imperial source for the production of the best possible strains of herbage plants it is incumbent upon the Dominion to know the exact requirements of the consuming country, and in this respect the Aberystwyth Station can be of great assistance in the determination of and reporting upon types that may be particularly suitable to the needs of the British farmer.

CERTIFICATION OF SEED POTATOES.

CERTIFICATES ISSUED ON FINAL TUBER INSPECTION, AUGUST, 1930.

Auckland Short-top (N.Z. Sutton's Supreme).

Weeber Bros., Belfast.
F. Brundell, Camside, Kaiapoi.
J. Jellie, Russley Road, Fendalton.
W. E. Martin, R.M.D., East Eyreton.
G. Harris, Milford, Temuka.
A. J. Rich, R.M.D., Kaiapoi.
W. Oakley, R.M.D., Halkett.
D. Marshall, R.M.D., Killinchy.
J. Rouse, Pareora, via Timaru.
R. Barnett, Dunsandel.
T. O'Brien, St. Andrews.
A. D. Carroll, R.M.D., Southbridge.
C. Redmond, R.M.D., Kimberley.
C. H. Jordan, R.M.D., Kaiapoi.
M. Breen, Levels.
Muff Bros., Orari.

Auckland Tall-top (N.Z. Sutton's Supreme).

Weeber Bros., Belfast.
J. Warren, Russley Road, Fendalton.
H. S. Moore, Box 4, Kaiapoi.
J. Bailey, R.M.D., Kaiapoi.

Epicure.

D. Marshall, R.M.D., Killinchy.
W. Shellock, R.M.D., Mead, Rakaia.
G. McLachlan, R.M.D., Southbridge.

Dakota.

H. M. Marshall, R.M.D., Weedons.
W. A. McPhail, Mitcham, Rakaia.
W. Gee, Springlands, Blenheim.
W. J. Crozier, Mitcham, Rakaia.
E. Hinton, Templeton.
S. Cross, R.M.D., Rolleston.
C. E. Walker, R.M.D., West Melton.
Munro and Scarth, Lavington, Rakaia.
J. H. Doak, Barr Hill, Rakaia.

Robin Adair.

D. Marshall, R.M.D., Killinchy.

Majestic.

A. J. Clark, Box 34, Rangiora.
C. H. Wilson, Lorneville, Invercargill.

Arran Chief.

G. Jones, "Vale Royal," Halswell.

Early Regent.

M. Kelly, 502 Lincoln Road, Halswell.
Jas. Curragh, Templeton.

King Edward.

L. King, Glencoe R.M.D., Invercargill.
A. Anderson, Stirling.
J. McLeary, Mataura Island.
O. S. Mosley, Stirling.
A. H. Rose, Glencoe R.M.D., Invercargill.
C. E. Knowler, Tuatapere.
R. M. King, Tuatapere.

Iron Duke.

H. A. Hancock, Awahuri, Palmerston North.

Golden Wonder.

J. Warren, Russley Road, Fendalton.

Up to Date.

H. D. Norman, Tuatapere.
C. E. Walker, R.M.D., West Melton.

Bresee's Prolific.

D. Marshall, R.M.D., Killinchy.

NOTE.—See also previous lists published in the *Journal* for May, July, and August, 1930.

WEATHER RECORDS : AUGUST, 1930.

Dominion Meteorological Office.

GENERAL NOTES.

METEOROLOGICALLY, August in New Zealand is generally considered to be the last of the winter months, but the one just passed was characterized by distinctly spring-like weather, more especially during the latter half. Temperatures were cold in the early part of the month, when some rather severe frosts occurred at places most subject to them, but on the whole conditions were mild for the time of the year. Rainfall exceeded the normal in nearly all parts of the North Island. At a few places in Auckland Province, however, there was a deficiency. In the South Island the totals were above normal in the eastern portion from Marlborough to Dunedin, while in all the western half and the greater portion of Otago and Southland they were below. At Nelson City the amount of rain recorded during the past three months has been the lowest for this period since records were commenced in 1883. Owing to an almost continued low rainfall since January, the subsoil in Central Otago has become dry for a considerable depth.

The mild temperatures and the ample rainfall induced a marked growth of pastures in most districts. Compared with the corresponding time of last year the season is in this respect further advanced. Consequently stock generally were reported to be in good condition, and at the close of the month the prospects for the lambing season and for dairying appeared excellent.

The finest weather occurred between the 13th and 23rd, the only interruption being due to the passage of a shallow cyclone over the South Island on the night of the 16th and during the 17th, when fairly general but light rain fell.

The most notable pressure disturbance affecting the Dominion during the month was an intense and extensive cyclone, which, advancing over the northern Tasman Sea on the 3rd, moved gradually on to New Zealand. Its central portion crossed the Cook Strait region during the night of the 6th, and barometer readings were very low while it was passing. On the morning of the 6th Chatham Island reported a pressure of 28.9 in. General rains occurred during the 4th and 5th, with many heavy falls. Three days of almost ceaseless rain at Christchurch caused surface-water to accumulate in many parts of that city, and rather severe floods were experienced in the area through which the Heathcote River flows.

Another cyclone, but a much shallower one, brought dull misty weather between the 9th and the 12th, mainly to the North Island and the eastern portion of the South Island. Though the rain was mainly light, some heavy falls occurred during the 10th and 11th between Hawke's Bay and Castlepoint, and some flooding resulted.

From the 24th to the close of the month much dull and misty weather prevailed, this being associated with several small cyclones which crossed the Dominion. The rainfall during this period was chiefly light and scattered, but on the 24th and the 28th more general rain was experienced with a few heavy falls. Wellington, for instance, had 152 points for the twenty-four hours preceding 9 a.m. on the 25th, the heaviest fall recorded in the city so far this year.

Fortunately, strong winds were infrequent, and the month on the whole was consequently a mild and pleasant one.

RAINFALL FOR AUGUST, 1930, AT REPRESENTATIVE STATIONS.

No.	Station.	Total Fall.	Number of Wet Days.	Maximum Fall.	Average August Rainfall.
<i>North Island.</i>					
		Inches.		Inches.	Inches.
1	Kaitaia	6.76	17	1.41	5.10
2	Russell	4.20	15	0.96	5.55
3	Whangarei	5.29	17	1.07	6.90
4	Auckland	3.39	15	0.65	4.26
5	Hamilton	3.00	16	0.78	4.02
5A	Rotorua	6.31	14	1.47	4.97
6	Kawhia	4.29	11	0.90	4.54
7	New Plymouth	9.54	17	2.76	5.37
8	Riversdale, Inglewood	10.68	17	3.22	8.65
9	Whangamomona	6.12	14	1.25	5.83
10	Eltham	6.88	15	1.35	3.82
11	Tariua	5.31	16	1.99	6.33
12	Tauranga	5.58	18	2.12	4.29
13	Maraehako Station, Opotiki	8.54	16	1.52	5.20
14	Gisborne	6.08	17	1.65	4.39
15	Taupo	5.72	17	1.05	4.06
16	Napier	4.29	13	1.23	3.54
17	Hastings	5.80	16	1.50	3.27
18	Taihape	3.41	13	1.43	2.80
19	Masterton	5.38	14	0.94	3.48
20	Patea	4.30	14	1.48	3.50
21	Wanganui	4.04	8	1.34	2.73
22	Foxton	3.16	14	1.20	2.89
23	Wellington (Karori Reservoir)	4.83	17	1.80	4.35
<i>South Island.</i>					
24	Westport	4.83	15	1.04	7.70
25	Greymouth	4.94	13	1.46	7.38
26	Hokitika	8.62	13	2.96	9.29
27	Ross	8.11	14	3.61	10.40
28	Arthur's Pass	8.75	8	2.83	12.78
29	Okuru	11.27	15	2.09	11.46
30	Collingwood	..	..	..	6.96
31	Nelson	2.83	11	0.95	3.93
32	Spring Creek	3.97	13	1.03	2.73
33	Tophouse	3.01	11	0.52	4.64
34	Hanmer Springs	2.54	14	0.81	3.09
35	Highfield, Waiau	3.84	10	1.18	2.26
36	Gore Bay	4.52	10	1.63	2.12
37	Christchurch	3.64	12	1.60	1.83
38	Timaru	3.00	11	1.22	1.41
39	Lambrook Station, Fairlie	1.96	8	0.84	1.43
40	Benmore Station, Clearburn	1.76	8	0.65	1.45
41	Oamaru	3.33	13	1.54	1.71
42	Queenstown	1.35	9	0.36	1.93
43	Clyde	0.37	5	0.09	0.80
44	Dunedin	3.46	14	1.09	3.14
45	Wendon	0.47	6	0.14	2.26
46	Gore	..	..	..	2.31
47	Invercargill	2.04	14	0.38	3.31
48	Puysegur Point	6.04	19	1.30	7.20
49	Half-moon Bay	2.00	11	0.29	4.35

—Edward Kidson, Director of Meteorological Services, Wellington, 6/9/30.

ANSWERS TO INQUIRIES.

IN order to ensure reply to questions, correspondents must give their name and address, not necessarily for publication, but as a guarantee of good faith. Letters should be addressed to the Editor.

HAND-REARING OF LAMBS.

“INQUIRER,” Pihautea :—

Would you kindly advise me the best method of rearing a lamb on cow's milk, and what quantity to give at a feeding? I have been using three parts of milk and one of water, but find the lamb very constipated.

The Live-stock Division :—

The successful hand-rearing of lambs on cow's milk is generally a fairly easy matter, provided care is taken to see that the young animal is fed a limited amount of milk at frequent intervals. As the lamb becomes older the intervals between feeding can be increased. Young lambs require about two or three tablespoonfuls of cow's milk every two or three hours during the first few days. The milk should be selected from a cow giving a good butterfat test, or if such cannot be obtained a little cream should be added to whole milk. The milk should be placed in a bottle the mouth of which is covered with a medium-sized nipple, and the whole warmed to blood heat before being fed. The nipple and bottle should always be carefully cleaned, or digestive trouble may result. Skim-milk should not be used, nor should water be added to cow's milk. Ewe's milk contains a higher percentage of fat than cow's milk, and no doubt the constipation you mention resulted from using cow's milk diluted with water.

MINERAL LICKS FOR DAIRY COWS.

WILLIAMS BROS., Otane :—

We wish to make up a loose iodized salt-lick for dairy cows, and would be much obliged if you could give the ingredients and their proportions for a lick, also containing the other minerals most often lacking in the soil. We have tried several licks which are on the market, but find them very expensive feeding. Further, would it not be possible to have an iodized lick without salt, and to feed rock salt separately? The cows seem to go for the made-up licks more for the salt than the other minerals. If salt was necessary, could it not be in a small proportion, just enough to make the lick liked by the cattle?

The Live-stock Division :—

With regard to the question of licks for stock, minerals provided in this manner can only be considered as supplementary to the amount of minerals in the pasture. There is no doubt that top-dressing not only increases the amount of feed, but also supplies feed rich in mineral content. The minerals required in largest amounts by dairy cows are calcium (lime) and phosphorus. Sodium and chlorine are supplied by rock salt. It is usual to add a small percentage of iron. If iodine is necessary, in many districts this mineral is required in very small amount. It is not an easy matter to prescribe iodine other than as iodized salt. This is prepared by dissolving 3 oz. iodide of potassium in $\frac{1}{2}$ pint water and spraying this over 100 lb. salt during mixing. The actual daily dose of iodine is very small, and in this manner the dose can be regulated. A mineral lick which would probably meet your requirements for dairy cows is made up as follows: Common salt, 28 lb.; sterilized bone-flour, 50 lb.; air-slaked lime, 20 lb.; sulphate of iron, 2 lb.; potassium iodide, 3 oz. As already mentioned, the iodide is dissolved in $\frac{1}{2}$ pint of water and sprayed over the other ingredients during mixing. The lick is placed in boxes protected from the weather and within easy reach of the stock. Occasionally stock do not take readily to bone-flour. Salt is added with a view to increasing the consumption of bone-flour, which contains the most essential minerals—calcium and phosphorus.

TRIMMING OF LAWSONIANA.

C. E. BOWRON, Pt. Omer, via Picton :—

I should be glad if you would advise me as to trimming *Lawsoniana* for making a hedge. How old should the trees be, before trimming, and at what time of year they should be trimmed?

The Horticulture Division :—

Cupressus Lawsoniana is most suited for a shelter hedge 12 ft. or 15 ft., and it then requires little or no pruning, as it is naturally clothed with branches about the base. If you desire to establish a hedge lower than this, cut off the leading growth as it attains the desired height (not before), and prune the side branches in to the desired width. These operations should be performed just before growth commences on young plants; otherwise, the autumn, about the month of April, is very suitable.

J. D., Westmere :— ENSILAGE FOR DAIRY COWS.

We are feeding freshly calved cows on hay at night and ensilage in the morning. What is a full ration of ensilage for a newly calved cow? Can they come to any harm by eating as much of it as they want through the day?

The Live-stock Division :—

A full ration of ensilage for a dairy cow would average from 50 lb. daily upwards, depending upon the breed of the animal and the amount of roughage and other feed available. Dairy cows milk well on ensilage, and provided the quality is above suspicion, no harmful results may be expected. The practice of feeding hay together with ensilage is one to be commended. If the ensilage has been prepared from very young crops more hay is desirable. The feeding-value of grass silage compared with roots and hay has been tested, and is stated as follows: Silage is superior in feeding-value to meadow hay and roots where it replaces them on a basis of 8½ lb. of grass silage to 10 lb. of mangels plus 1 lb. of meadow hay.

AGRICULTURAL SHOWS, SEASON 1930-31.

THE following show-dates have been notified by agricultural and pastoral associations :—

- Ellesmere A. and P. Association : Leeston, 16th October, 1930.
- Hawke's Bay A. and P. Society : (**Royal Show**), Tomoana, 21st to 23rd October.
- Poverty Bay A. and P. Association : Gisborne, 28th and 29th October.
- Wairarapa A. and P. Association : Carterton, 29th and 30th October.
- Timaru A. and P. Association : Timaru, 29th and 30th October.
- Marlborough A. and P. Association : Blenheim, 31st October and 1st November.
- Manawatu A. and P. Association : Palmerston North, 5th, 6th, and 7th November.
- Northern A. and P. Association : Rangiora, 7th November.
- Wanganui A. and P. Association : Wanganui, 12th and 13th November.
- Canterbury A. and P. Association : Christchurch, 13th and 14th November.
- Egmont A. and P. Association : Hawera, 19th and 20th November.
- Stratford A. and P. Association : Stratford, 26th and 27th November.
- Otago A. and P. Society : Dunedin, 26th and 27th November.
- Nelson A. and P. Association : Richmond, 28th and 29th November.
- Wyndham A. and P. Society : Wyndham, 5th December.
- Southland A. and P. Association : Invercargill, 9th and 10th December.
- Helensville A. and P. Association : Helensville, 29th January, 1931.
- Feilding A. and P. Association : Feilding, 3rd and 4th February.
- Masterton A. and P. Association : Solway, 17th and 18th February.
- Marton A. and P. Association : Marton, 25th February.
- Auckland A. and P. Association : Auckland, 26th, 27th, and 28th February.
- Taranaki Agricultural Association : New Plymouth, 4th and 5th March.
- Waikato Central Agricultural Association : Cambridge, 4th and 5th March.
- Mayfield A. and P. Association : Mayfield, 14th March.
- Methven A. and P. Association : Methven, 28th March.